RESOURCE GUIDE
to accompany
The Exploring Science Program
BLUE BOOK (3)

by
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Billee Davidson
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Doubleday Canada Limited
Toronto

Doubleday Australia
Sydney


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TEACHER'S RESOURCE GUIDE
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Illustrated by Li-Wen Wang

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TEACHERS' RESOURCE GUIDE
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BLUE BOOK (3)

PURPOSES

The two main purposes of the *Teacher's Resource Guide* to accompany *The Exploring Science Program —Blue Book (3)* are to:

1. provide you, the teacher, with some background information about the concepts, processes, and topics being developed in each unit.

2. suggest a wide variety of teaching strategies and learning activities for each unit, that complement, extend or reinforce the material presented in the textbook, and give you the resources to design a program that meets the needs of individual students.

FEATURES

The Unit Overview

The Unit Overview consists of the following sections:

Concept Development. The main concepts of the unit are discussed in terms of how they are developed in the unit; how they were introduced and presented in the preceding units and how the concept relates to child development.

Process Development. This feature describes the processes that are developed in the activities of the unit. It also includes some in-depth discussions of process skills that particularly relate to that unit.

Related Units. All units in the Exploring Science Program that further develop a concept, or that develop related concepts, are listed.

Materials and Advance Planning. Materials needed for a student, or a group of students, to carry out the activities, are listed. In some instances, suggestions are made for advance planning.

Background Information

The purpose of this feature is to provide you with additional information on the topics presented in the text. You may wish, at your discretion, to inject some of this additional information into class discussions.

Teaching Strategies

The Teaching Strategies include:

Suggested activity, discussion, or research. These suggestions are meant to extend, reinforce, or complement the concepts and processes presented in the text. They are interdisciplinary in nature.

Worksheets. These worksheets may be reproduced for use by individual students. They can be used to review or record material presented in the unit.

Activity Cards. The activity cards may be used in learning centres, or by individual students. They generally pose a question, or make a statement, that allows for further activity, investigation, discussion, or research.

YEAR	LIVING THINGS (Biological Sciences)	MATTER AND ENERGY (Physical Sciences)	THE EARTH AND SPACE (Earth-Space Sciences)
ORANGE BOOK (1)	Your Senses Living Things	Sorting Light and Shadows	Time Spaces and Places
GOLD BOOK (2)	Food for Animals and You Environment	Measuring Magnets	The Moon Rocks and Soil
BLUE BOOK (3)	Seed Plants Animal Behaviour	Heat and Temperature Sounds Around You	Water in Your Environment Location, Motion, and Force
BROWN BOOK (4)	Plant Growth and Behaviour Animals and Their Environment	Work and Machines Solids, Liquids, and Gases	Air and Weather Watching the Sky

GREEN BOOK (5)	Small Living Things Your Body	Electricity on the Move Light	The Changing Land Mapping the Earth
RED BOOK (6)	Interacting with your Environment Plant and Animal Life Cycles	Matter and You Changes in Energy	The Earth in Space Ecosystem Earth
(7)	Ecology: Interaction in the Environment Biology: The Study of Living Things The Human Body: A Study of Yourself	Science: Something People Do Energy: For Work and Motion Technology: Using Science	Earth: Its Nature and Importance to You Weather: The Changing Atmosphere Water: More than a Resource Universe: Exploring Environments in Space

SCIENCE PLANNING OUTLINE

TEACHER _____ GRADE _____

	BIOLOGICAL	PHYSICAL	EARTH-SPACE
SEPTEMBER			
OCTOBER			
NOVEMBER			
DECEMBER			
JANUARY			
FEBRUARY			
MARCH			
APRIL			
MAY			
JUNE			

SCHOOL-WIDE PLAN DATE: _____	BIOLOGICAL	PHYSICAL	EARTH-SPACE
YEAR 1			
YEAR 2			
YEAR 3			
YEAR 4			
YEAR 5			
YEAR 6			
YEAR 7			

BLUE BOOK (3)
Unit 1: Seed Plants

Pages 6-31

UNIT OVERVIEW

Concept Development

In the preceding levels of the program, the following concepts were introduced and developed.

There are many kinds of living things. The two broad groups of living things are the plant and animal kingdoms. Some of the characteristics of plants are growth and change. These changes occur in sequence. Plants reproduce their own kind and make food. In order to survive, plants need warmth, light, soil and water.

In this unit the students' exploration of the plant kingdom becomes more specific. Students will have heard plants called by a number of names, such as "flowers", "shrubs", "trees", "weeds", "grass", etc. However, they may not recognize these different types of plants as belonging to the same classification. Because of variations in the appearance, shape and size of plants, students may still not have a clear understanding of the concept of "plant". In this unit, by considering a division of plants called "seed plants", students will develop an understanding of: the structure, function and needs of seed plants; the sequence of changes that seed plants undergo during their life cycles; and the way that seed plants can be classified, or grouped, by their similarities and differences.

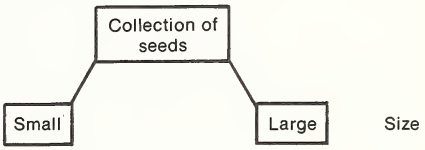
Unit 1, "Seed Plants", consists of four chapters. Chapter one discusses the importance of seed plants. Chapter two considers the structure of seeds, how seeds are adapted for travel and the conditions that are needed for seeds to germinate. The growth needs of seed plants are outlined in the third chapter. In chapter four the various structures and functions of a seed plant are discussed.

Process Development

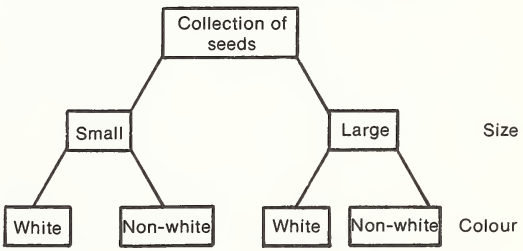
Students carry out simple, systematic investigations that involve one or two *variables*. They *observe* how seeds grow under certain conditions. Students use these observations to make *comparisons*, *inferences* and *predictions*. There are also opportunities for students to develop *classification systems*.

In the *classification* activities in the unit, you may wish to have your students start by dividing their collections into two subsets, using one observable property. This is a *single stage classification system*. Properties such as shape, size, colour, weight and texture may be used to sort the collections. You may wish to have your students sort their collections into further subsets. By using more than one property to define each grouping, students will be developing *two-stage* or even *multi-stage classification systems*.

Single Stage Classification System



Two-Stage Classification System



Students first *observe* the structure of some seeds, and *compare* their likenesses and differences (page 15). They then *investigate* the needs of growing plants in a series of activities. In each activity they *control a variable*: water (page 16), soil (page 19) and light (page 20). From their observations and comparisons, they make *inferences* about the needs of growing seed plants.

The parts and functions of plants are then investigated on pages 23 and 27. Students are asked to make *inferences* and *hypotheses* from their observations.

Related Units

Living Things *Orange Book (1)*
Environment *Gold Book (2)*
Plant Growth and Behaviour *Brown Book (4)*
Small Living Things *Green Book (5)*
Plant and Animal Life Cycles *Red Book (6)*
Biology: The Study of Living Things *Exploring Living Things (7)*

Materials and Advance Planning

The following list includes the materials that a student, or in some cases a group of students will need to carry out the activities in this unit. In some instances, other materials may be substituted for those on the list.

16 seeds (lima beans or kidney beans), 3 drinking glasses, 2 plastic or glass jars, paper towels, 12 seedlings (grown from lima beans or kidney beans), 4 milk cartons, scissors, soil, fresh celery stalk with leaves, food colouring, potato, carrot, knife, a variety of seeds, watermelon seeds, absorbent cotton, 30 radish seeds, birdseed, 2 sponges.

Plant the seeds (lima or kidney beans) in preparation for the "Finding Outs" on pages 19 and 20.

BACKGROUND INFORMATION

Chapter 1: Why are seed plants important?, pages 8-11

In this chapter students are introduced to a division in the plant kingdom called "seed plants". They develop an understanding that, although seed plants might have variations in appearance, shape and size, their one common property is that they grow from seeds. They are made aware also of the importance of seed plants to people.

More than half of all the plants growing on the earth are seed plants. They include all the common herbs, shrubs and trees. They are separated into two major groups by their method of seed production. In the one group, known as the gymnosperms, there are no flowers, and the seeds are produced in cones. Some examples of gymnosperms are pine, cedar, spruce, fir and hemlock trees. The other group, known as the angiosperms, are flower-producing plants that bear their seeds in seed cases. This unit discusses angiosperms in detail.

Seed plants are important to people in many ways. One function is as a source of food. The fruits from seed plants, such as tomatoes and green peppers can be eaten. From other seed plants, it is the seeds which form the food source. Corn, wheat and rice are seeds that are used to make such things as breads and cereals. Spices such as mustard, pepper and nutmeg are made from the seeds of certain plants.

Another way that seed plants are important to people is as a source of raw materials which are used to produce other products. These raw materials can be obtained from the seeds of some plants. For example, the oils extracted from coconuts, soybeans, sunflower seeds and cotton seeds are used to make such products as cooking oils, salad oils, soaps and candles. In addition, certain oils are used in the making of perfumes, linoleum, paints, varnishes, insecticides and many other things. There is even a use for the pulp which is left after the oil has been removed from the seeds. It's used to feed poultry and cattle. Raw materials can also be obtained from other parts of some seed plants. The fibres surrounding cotton seeds are used to make cotton cloth. Trees, which also are seed plants, are used in the production of paper and in the construction of furniture and buildings.

Besides serving as sources of food and raw materials, a third way that seed plants are important to people is their use in landscaping. Grasses, for example, are used not only to beautify yards, parks and roadways but also to prevent soil erosion. In addition, many seed plants have colourful flowers which are used to beautify our surroundings.

A fourth reason why seed plants are important to people is that certain plants are sources of medicines. Such medicines include quinine, digitalis, penicillin and cortisone.

Chapter 2: A closer look at seeds, pages 12-16

In this chapter, the concept is introduced that seeds have structures that enable them to carry out their functions. The conditions necessary for seeds to germinate are also considered. The chapter begins with the concept that the differences in properties for each kind of seed can be found by comparing it to another kind of seed. Some of these properties are size, colour, shape and function.

Some of the properties of seeds are adapted to help them to be moved from one place to another. Some seeds have properties which enable them to be picked up and carried by the wind. For example, milkweed and dandelion seeds have hairlike fibres attached to the seeds and others, such as maple and ash seeds, have a winglike shape. Some seeds can be carried from one place to another by water. Many wing-shaped seeds float. The structure of some seeds enables them to be carried by animals or people. Burrs, for example, have sticky or barbed spines that easily cling to animals' fur and to people's clothing. In this way, burrs may be carried for great distances before they are brushed or pulled off. Some seeds can travel because their pod pops open scattering the seeds. Violet seeds grow within such a pod or capsule which dries and pops open.

The chapter then discusses some similar elements in the structure of seeds. For example, all seeds have a covering called a seed coat that protects the inner parts of the seeds. Another property all seeds have in common is one or more cotyledons, or seed leaves. Cotyledons contain stored food. In some seeds, such as beans, there are two cotyledons and the stored food is split into two parts. Such seeds are called dicotyledons or dicots for short. (The prefix "di" means two) In other seeds, such as corn, there is only one cotyledon, and the stored food is not split. Such seeds are called monocotyledons or monocots. (The prefix "mono"

means one.) A third property which all seeds have in common is a tiny plant that has tiny roots, a stem, and leaves. That tiny plant is called an embryo. It is the embryo that eventually grows into a new seed plant.

Besides their common structure, all seeds must have certain conditions to germinate or to begin to grow. Those things are water, oxygen from the air and an optimal temperature range. Most seeds will germinate only if they are planted within a year of their ripening. However, corn that is two years old, beans that are three years old, cucumber seeds that are ten years old and wheat that is thirty years old have been known to germinate.

Chapter 3: What do seed plants need to grow?, pages 17-20

In this chapter, students are introduced to the additional needs seed plants have in order to grow, to remain healthy and to survive. Seed plants—like seeds—need water, air and an optimal temperature to grow. However, once the seedling has used up the food supply from the seed, it needs to manufacture its own food. In addition to water, air and temperature, seedlings also require light and minerals.

Chapter 4: Other parts of seed plants, pages 21-27

The concept is stressed in this chapter that a seed plant has specialized structures and parts that carry out specific functions necessary for the survival of the plant. These structures and functions are interdependent.

One structure of a seed plant that is necessary for the survival of the plant is the root. Just as there are many kinds of seed plants, there are also many kinds of roots. For example, the roots of dandelions are called tap roots. The roots of carrots are fleshy roots. Grasses have fibrous roots. In addition to their regular roots some plants, such as corn, have prop roots which provide the plant with additional support by growing from the stem of the plant into the soil. Even though there are many kinds of roots, most root structures carry out the same functions. Such functions include: absorbing water and dissolved minerals from the soil, storing food and anchoring other parts of the plant in the soil.

Another structure of a seed plant is the stem. Like the root, it is necessary for the survival of the plant and there are several different kinds. Woody stems have a rough exterior like those of most trees. There are also herbaceous, or nonwoody, stems such as the stem of the tulip. Some stems, such as the bulb of a lily and the tuber of the white potato, grow underground. Although there are many kinds of stems, all stems carry out the same basic functions. The stem supports the leaves, flowers and fruits. The stem also transports water, food and dissolved minerals to other parts of the plant. The transportation is carried out by the plant's vascular system, which is made up of two special kinds of tissues called xylem and phloem. These tissues extend from the roots of the plant to the leaves. The xylem transports water and dissolved minerals from the roots to the leaves. The phloem transports food from the leaves to all other parts of the plant. In addition to these basic functions, some stems are active in the reproduction of the plant. Pieces of stems of grapevines and rosebushes, called slips or cuttings, grow into new plants if they receive the needed care.

Leaves make food for the plant in the following way: When light shines on the leaf, the chlorophyll within that leaf changes the light energy into chemical energy. That energy is then used by the leaf to change water and carbon dioxide into sugar. The sugar may then be used immediately by the plant, be stored as a starch, or be mixed with minerals to form nutrients other than sugar that the plant needs. This process of food making is called photosynthesis. An important by-product of photosynthesis is oxygen, which is given off into the air and which people need to survive.

Besides the necessary functions carried out by the roots, the stem and the leaves, flowers also carry out an important function for angiosperms, or flower-producing seed plants. That function is the production of seeds, from which new angiosperms grow. A typical flower begins as a bud which grows on a receptacle, or an expanded stem tip. Enclosing the bud are green leaflike structures called sepals. Within the sepals are the petals of the flower. And surrounded by the petals are the anthers, the stigma and the ovary. The anthers produce pollen, the stigma catches pollen and the ovary produces an ovule or ovules. When caught by the stigma, the pollen grows a tube from the stigma to the ovary and fertilizes an ovule or ovules within the ovary. The fertilized ovules develop into embryos. The embryos grow into mature seeds which are capable of growing into new seed plants if conditions around the seeds are favourable for their growth. Some angiosperms have imperfect flowers, or flowers that do not have all the parts necessary for independent reproduction. For example, some imperfect flowers have only anthers. Other imperfect flowers have only a stigma and an ovary. Therefore, for reproduction to take place, the pollen from the anthers of the one kind of plant must reach the stigma of the other kind of plant. The transfer of pollen from one plant to another is called cross-pollination, and it is most often accomplished through the help of insects or the wind.

TEACHING STRATEGIES

The purpose of the following activities and teaching strategies is to provide you, the teacher, with a wide variety of suggestions that can be used, together with the material presented in the textbook, to help guide your students in developing the processes and concepts of this unit.

Chapter 1: Why are seed plants important?, pages 8-11

— Pages 7-9 can be read and discussed.
— Students could collect magazine pictures of fruits, vegetables and commercial food products made from seeds. These pictures could be classified according to the use made of the seed and then made into collages, each in the shape of a huge seed.
— For special occasions, students could prepare a small gift of sugared pecans or peanut brittle. Recipes are described on Activity Card 1. The children could make colourful paper baskets or wrap them in cellophane and tie them with bright ribbon.
— A variety of nuts such as walnuts, filberts and almonds could be sampled by the class. At the same time, students could be *observing* the shape, size and colour of the shells.
— The game Crunchy Nuts could be played. About six students are blindfolded and each handed a nut. They must *predict* what kind of nut it is by feeling its outer covering and shape. The class is told the answer in advance. The same procedure would follow with another group examining a different kind of nut. Everyone would love to sample each kind!
— Pages 10-11 can be read and discussed.
— Students could make a collection and display foods which contain peanuts (e.g. peanut butter, brittle, peanut oil, Spanish peanuts, dried and salted peanuts, etc.)
— Game—The class divides into three teams. Each team takes a turn offering suggestions (to *hypothesize*) of ways that people use seed plants. If a team suggests the correct use of a seed plant, it gains five points. If an item is repeated, the team loses two points. Each item is listed on the board when given. Students could write these items in their notebooks at the end of the game.
— The children could collect data on the kinds of seed plants in their own flower or vegetable garden. "Seed Plants in My Garden, Activity Card 2" is available to use.
— "A Second Look, Worksheet 1" has been included for review purposes.

Chapter 2: A closer look at seeds, pages 12-16

— Pages 12-13 can be read and discussed.
— A variety of seeds could be available for students to examine and classify (e.g. sesame, sunflower, pumpkin, pepitas, corn, radish, kidney and mung beans). They could be *classified* according to:
  (a) size (tiny, small, large, very large)
  (b) colour (light, medium, dark)
  (c) shape (round, oval, long, irregular)
  Egg cartons are useful to act as sorting trays with one for each classification. The class could discuss the different ways that the seeds were sorted.
— Students should work independently at this activity *measuring* the size of a variety of seeds. The seeds could be placed in dishes or muffin tins in a science centre. Each kind of seed should be labelled for reference (e.g. apple, almond, coconut, sunflower, peach stone). "Big Seeds, Little Seeds, Activity Card 3" is available to record measurements.
— You might wish to have the students discover that all seeds from the same kind of plant are not always the same size. If so, "How Big is Big?, Activity Card 4" can be used.
— The class could be divided into groups to explore how seeds travel. Each group could conduct experiments using milkweed, dandelion, maple and ash seeds. Activity Cards 5-9, "Flying", "Whirling", "Floating", "Catching a Ride" and "Thinking Coconuts" are available for students' responses. Each group could report their findings to the class as well as give a quick demonstration with their seeds.
— The class could *brainstorm* other ways that seeds can be transported (e.g. squirrels gathering and storing seeds, seeds discarded by people, birds carrying seeds).
— Pages 14-15 can be read and discussed.
— Worksheets 2 and 3 for "Finding Out" (pages 15 and 16) have been provided for students' use.
— "A Second Look (page 16), Worksheet 4" has been provided for review purposes.

Chapter 3: What do seed plants need to grow?, pages 17-20

— Pages 17-18 can be read and discussed.
— If you wish to extend the concept that "plants need warmth", then "Growing, Activity Card 10" offers students a variety of situations to experiment with this concept.
— "The Radish Experiment" has been designed to reinforce the concept that "plants need air to grow". You may wish to use Activity Card 11 for this experiment.
— Worksheet 5 for the "Finding Out" on page 19 is available to record students' observations.
— If you wish to add *variables* to the "Finding Out" activity on page 19, you could pose the question: "Do you think seeds would grow if 'watered' with orange juice, apple juice or coke?" See "Other Liquids, Activity Card 12".
— "Mr. Sunshine Test, Activity Card 13" can be used to extend the "Finding Out" on page 20.
— "A Second Look, Worksheet 6" is available for review of Chapter 3.

Chapter 4: Other parts of seed plants, pages 21-27

— Pages 21-22 can be read and discussed.
— Students would enjoy conducting the "Finding Out" experiment (page 23). Their findings can be recorded

on Worksheet 7, "A Celery Surprise".

— The "Extending the Finding Out" activity (teacher's guide page 23) would provide decorations for a school activity or as a gift for a special occasion (e.g. Thanksgiving, Mother's or Father's Day, Easter, graduation class).

— Leaves — The class could go outside and *collect* a variety of leaves. These leaves can then be *classified* according to shape (e.g. simple leaves with one blade, compound leaves with two or more blades). The outlines of the leaves could be traced in the student's notebooks. If possible, they could print the name of each leaf. Having completed the above task, the leaves could be *sorted* from smallest to largest.

— Pages 24-26 can be discussed.

— "Activity Card 14, Thinking About Leaves" can be given to students to develop critical thinking skills.

— To culminate this unit, students could go to a library and research the types of seed plants that grow in a desert, a jungle, in the water and on a prairie. Each student could make a box mobile covered in bright paper. Their information could be printed on separate pieces of paper and glued to the sides and bottom of the box. Mobiles can be hung at eye level for students to enjoy. Pictures could also be included.

— Enrichment Activity Cards 15-1 to 15-12 for this unit could be placed in the science centre. As an art activity, students could make large flowers to be placed in flower pots or in a miniature garden. An enrichment activity could be placed on the back of each flower. Students can pick a flower and complete the activity.

— Worksheets 8 and 9 for "Finding Out" (page 27) and "A Second Look" (Page 27) have been provided.

— Students enjoy doing cartoons and "It's Cartoon Time!, Activity Card 16" allows students to develop dialogue between two beans.

SUGARED PECANS

You will need: 500 mL pecans (halves)
2 egg whites
125 mL sugar
10 mL ground cinnamon
5 mL nutmeg (or ground cloves or allspice)
1 mL ground ginger (or cardamom)
Small amount of cooking oil
Cookie sheet, and cooling rack

Set oven at 160°C.

In a bowl put 2 cups of pecan halves. Add 2 egg whites. Stir until the pecans are covered.

In another bowl put sugar, cinnamon, nutmeg and ginger.

Use a big spoon with holes or slots to pick up the pecans. Put them in sugar and spices and toss them until coated.

Place the pecans on your oiled cookie sheet about 1 cm apart. Bake in the oven for 8 minutes. If they are brown and crisp, they are ready.

Let the pecans cool 1 minute. Lift them onto a rack to cool.

Store in a cool place. Makes about 3 cups.

PEANUT BRITTLE

You will need: 250 mL water
500 mL granulated sugar
250 mL light corn syrup
500 mL raw Spanish peanuts
2 mL salt
15 mL butter
5 mL soda
Small amount of butter
2 cookie sheets
one 3 L saucepan.
Candy thermometer

Butter cookie sheet.

Put water, sugar and syrup in the saucepan. Cook on medium heat until the sugar dissolves.

Cook to the soft ball stage (98° C). Add the nuts and salt.

Cook to the hard crack stage (140° C). Stir often. Remove from heat. Quickly stir in butter and soda.

Pour at once onto buttered cookie sheets. Spread.

Break up when cold.

Makes 750 g.

Seed Plants in My Garden

I found these kinds of seed plants in my garden. I have drawn a picture of each one and given its name.

Seed Plants, Activity Card 2

How Big is Big?

Measure 3 different watermelon seeds. Record the length and width of each seed on this chart.

Size	Seed #1	Seed #2	Seed #3	Seed #4	Seed #5
Length					
Width					

Repeat this with two other types of seeds. Record their sizes on the chart above.

1. Are all the seeds the same size?

2. What could affect the size of the seeds?

3. Are all people of the same age the same size?

4. What could affect the size of people?

Seed Plants, Activity Card 4

A Second L◕◕k (Page 11)

What are seed plants?

What are some ways seed plants are important?

What are some things people use that are made from seed plants?

Seed Plants, Worksheet 1

You will need: seeds
a ruler

Measure the size of each kind of seed. Write the name of the seed and its size in the boxes below. Have fun!

Kind of Seed	Size of Seed

The shape of seeds help them to travel.

Look at the dandelion and milkweed seeds. Draw a picture of their shape.

How are they the same?

How are they different?

How do you think they will move when thrown in the air? (Throw them in the air.)

Seed Plants, Activity Card 3

Flying!

The shapes of seeds help them to travel.

- Look at the dandelion and milkweed seeds. Draw a picture of their shape.

Dandelion ☐ Milkweed ☐

- How are they the same?
- How are they different?
- How do you think they will move when thrown in the air?
- Throw them in the air. Watch them. Were you right in your prediction?
- How did they move?
- What allows them to travel this way?
- Could they travel by water? _____ • What happens? Why?

Show a friend how your seeds move.

Seed Plants, Activity Card 5

A Closer look at how maple and ash seeds travel.

- Look at their shapes. Are they the same or different?
- How do you think they will move in the air?
- Now throw the seeds in the air. Observe how they move.
- What allows the seeds to move this way?

Whirling

Seed Plants, Activity Card 6

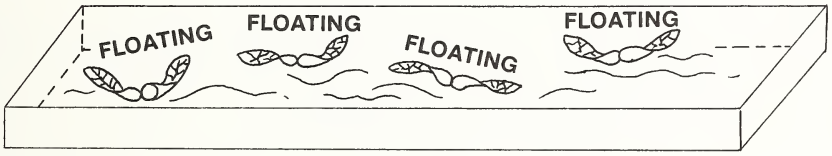
Floating

Float your maple and ash seeds in a bowl or pan of water.

Why do you think they float?

How do they move in the water?

What allows them to travel this way?



Show a friend how your seeds move.

Seed Plants, Activity Card 7

Catching a Ride

Seeds that are carried by animals and man:
Look at their shape. Feel them. Describe them.

How could these seeds travel on animals or man?

How would the seeds reach the ground?

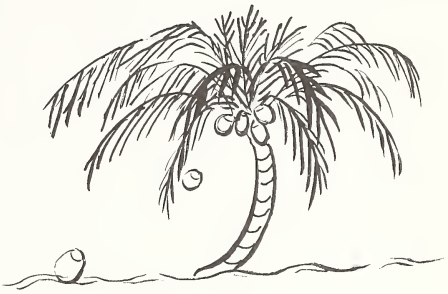
Stick the burrs to your clothing. Shake your body. What happened?

What kind of animals could transport burrs on their bodies?

Do you think that seeds and burrs would stick to rabbit fur? Try to attach a burr to this piece of rabbit fur. What happened?

Show a friend how the burr stuck to your clothing. Let your friend try it too.

Seed Plants, Activity Card 8



Coconuts grow in areas where there is water.
Do you think they could travel by water?

Try floating one in a pail of water.
What happened?

Seed Plants, Activity Card 9

FINDING OUT (Page 15)

What parts of the seeds did you find?

How are these seeds like the seed pictured on page 14?

How are they different?

Seed Plants, Worksheet 2

FINDING OUT (Page 16)

What happened to the seeds in the jar with water?

Why?

What happened to the seeds in the other jar?

Why?

Seed Plants, Worksheet 3

A SECOND LOOK (Page 16)

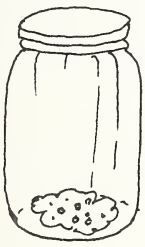
What are some ways seeds travel?

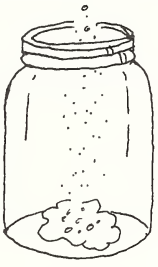
What are the three parts of a seed?

(a) (b) (c)

What do seeds need so they can grow?

Seed Plants, Worksheet 4





Growing

Do you think that seeds need warmth to grow? You will find out in this experiment.

You will need—mixed bird seed
3 jars with lids
3 pieces of absorbent cotton
a little water

Put a piece of dampened cotton in the bottom of each jar.

Sprinkle bird seed onto the cotton. Cover the jar with a lid.

Place one jar on top of a radiator or air vent.
Place the second jar on a table away from the radiator or air vent.
Place the third jar in a refrigerator.

Which jar of seeds do you think will show the most growth?

Observe your seeds' growth for a week. Keep a daily log of what you observe happening in each jar.

What have you learned about bird seed needing warmth?

Think carefully !!!

Desert?
Prairie?
Jungle?

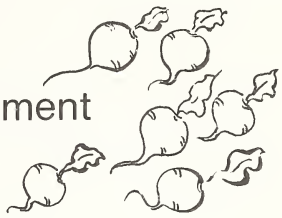
Can we say that all plants require the same temperature to grow?

Why?

Seed Plants, Activity Card 10

Seed plants need air to grow.

The Radish Experiment



You will need: 30 radish seeds
3 clear plastic drinking glasses
9 paper towels
3 labels

Fold two paper towels into a small square. Put in the bottom of a glass.
Repeat this with the other towels and jars.

Sprinkle ten radish seeds on each square.

Fold the other paper towels into squares. Put one towel on top of each group of seeds.

Label your glasses:

Radishes (date)

In the first glass—put 1 or 2 drops of water on the towel
second glass—soak the towel with water
third glass—fill the glass to the top with water

Look at the glass at the end of five days. What did you find?

Why do you think this happened?

Seed Plants, Activity Card 11

FINDING OUT (Page 19)

What happened to the plant in the carton with soil?

Why?

What happened to the plants without soil?

Why?

Seed Plants, Worksheet 5

Growing plants with Other Liquids

You will need: 4 to 6 seedlings (e.g. such as those from the "Finding Out" on Page 16)
a small milk carton
scissors
paper towels
One of these liquids: orange juice, pineapple juice, apple juice, tomato juice, Coke

Cut off the top of each carton.

Put some paper towels inside the carton as shown.

Push the seedlings between the towels and the inside of the carton.

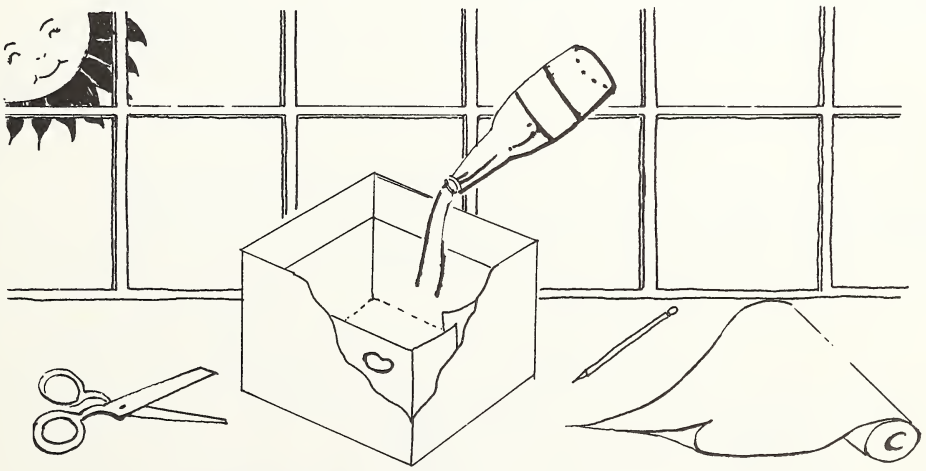
Put one of the juices in this carton. Do not cover the seedlings with water.

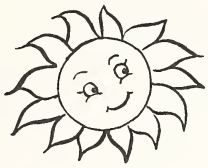
Place the carton by a window through which sunlight often shines.

Keep the paper towels damp for about 3 weeks.

What happened to the plants in the carton?

Why?



Mr.  Test

You will need: 2 bowls
bird seed or mixed grain from a seed store
2 sponges

Wet your sponges. Place one sponge in each bowl.

Fill the bowls with 1 cm of water.

Sprinkle some seed on each sponge.

Place one bowl in a very dark, warm place. (e.g. in a covered box placed on a hot air vent or radiator)

Place the other bowl by a warm, sunny window.

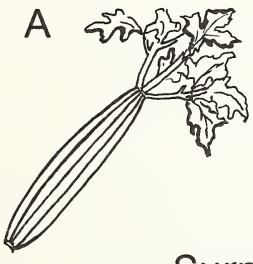
Check the bowls each day to make sure there is 1 cm of water in each.

Also check the seeds every day for two weeks. (Remember that you can't let light into the box. Take a quick look and cover the box again!)

What did you observe about the plants in the dark place and in the sunny place!

What have you learned about sunshine and plants?

Seed Plants, Activity Card 13

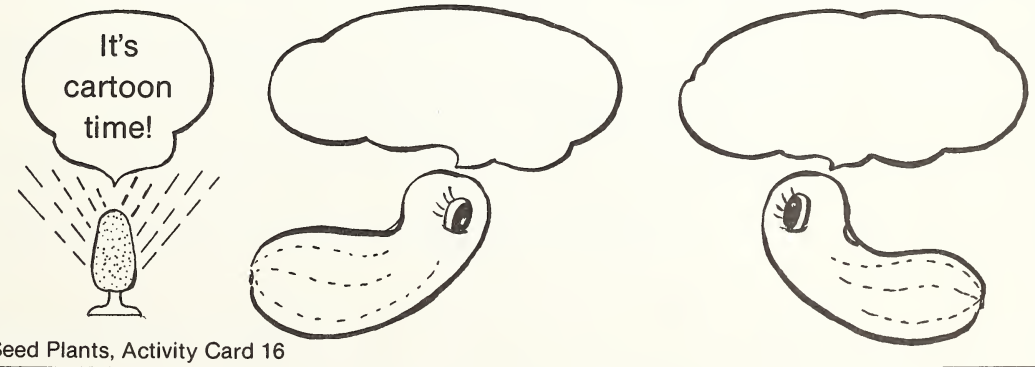
A 

Did the leaves or parts of the leaves turn red?

If so, how did the red water move through the stem to the leaves?

Surprise Page 23

Seed Plants, Worksheet 7



Seed Plants, Activity Card 16

A SECOND LOOK (Page 20)

What is a seedling?

What things do seed plants need so they can grow?

Seed Plants, Worksheet 6

A SECOND LOOK (Page 27)

What is the root, and why is it important?

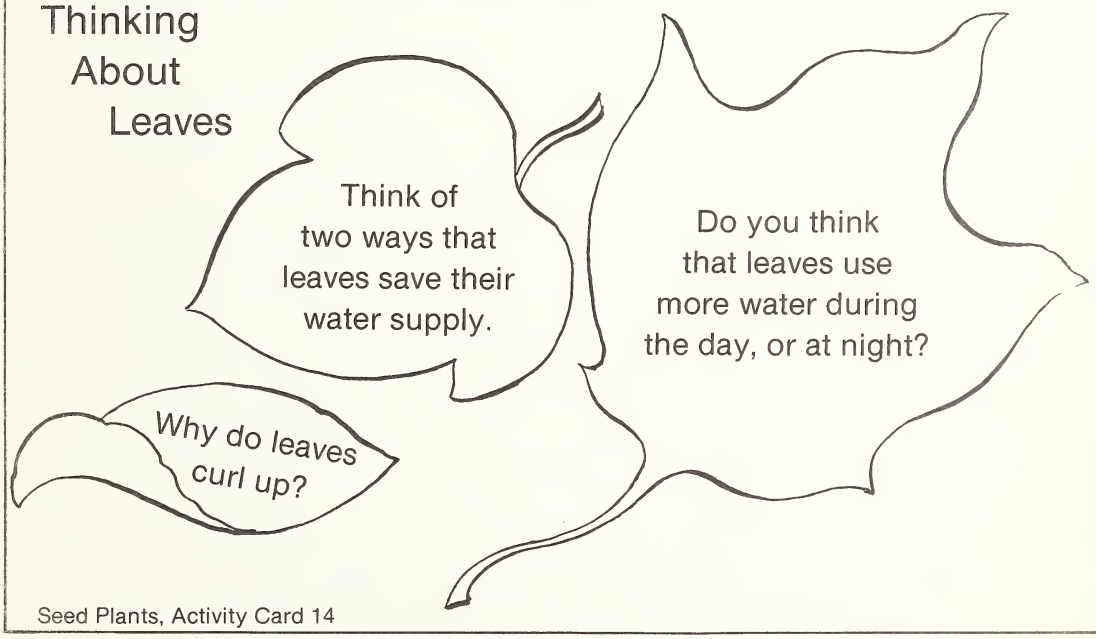
Why is the stem important?

What part of a seed plant makes food, and what things are needed to make the food?

Why is the flower important?

Seed Plants, Worksheet 9

Thinking About Leaves



Seed Plants, Activity Card 14

FINDING OUT (Page 27)

Did the pieces of stem and the piece of root grow?

If so, what does this tell you about the ways some plants can grow?

Seed Plants, Worksheet 8

Enrichment Activity Cards
Flowers

These can be cut out and pasted on the backs of flowers.

Make a necklace of seeds to wear.

Write some riddles about seeds. Try 4 riddles! Your friends would like to try them.

Make a fresh vegetable bouquet of "root" seed plants (e.g. beet, carrot, parsnip, radish, etc.) Tie a ribbon around it and give it to a friend!

Find out how an apple tree is grown. How do you start an apple tree? Does it need sun? Water? Why are some apples sour and others sweet? Give this information to the class.

Enrichment Activity Cards
Flowers

These can be cut out and pasted on the backs of flowers.

Find out how popcorn is produced. Make some for the class. Describe what you see, smell and hear when you pop corn.

Pretend that you are Johnny Appleseed. Tell the class why you are so famous. Will you dress up like him? You can find out about him in the library.

Make up a popcorn song to a well-known tune. Perhaps you could use instruments to make popping sounds.

Nuts are very nutritious. Go to the library and find out why. Tell your class why they should include nuts in their diet.

Enrichment Activity Cards
Flowers

These can be cut out and pasted on the backs of flowers.

A Yummy Jar is a small jar of edible seeds. The seeds are placed in layers of different shapes or colours. Tie a ribbon around it and give it to a friend.

Prepare a half slice of 5-grain bread for each of your classmates. You might wish to butter it. Inform the class (1) what grains are in the bread and (2) why it is more nutritious than white bread.

Pretend that you are a seed. Write a poem in which you are the speaker. You are trying to grow but you are having a few problems. What are your problems? It could be a funny poem. Have fun!

Grow some alfalfa sprouts for your class to taste. Explain to the class why this is the only kind of garden that does not require a green thumb, soil, or the sun.

BLUE BOOK (3)
Unit 2: Animal Behaviour

Pages 36-63

UNIT OVERVIEW

Concept Development

In the preceding levels of the program, the following concepts were introduced and developed:

Animals and plants form the two broad groups of living things. Some of the characteristics of animals are that they grow and change, move by themselves, reproduce, and care for their young. Animals need food, air, water and proper temperatures in order to live and grow. Animals obtain food from plants or other animals. All animals are part of food chains. A place where an animal lives is called its environment. Different kinds of animals are suited to living in different environments.

The following concepts are developed in this unit. Living things are continuously interacting with other living things and with the physical environment. The ability of an animal to respond or adapt to the environment is key to its survival. Behaviour is the way an animal responds or acts to conditions in its environment. Behaviour can be instinctive or learned.

Unit 2, "Animal Behaviour", consists of three chapters. The first chapter discusses how certain environmental factors such as heat, light and water affect an animal's behaviour. Chapter two develops the concept that certain kinds of animal behaviour result from instincts with which animals are born. Examples of instinctive behaviours are building nests, spinning webs, protecting the young, migrating and guarding territory. The third chapter discusses learned behaviour and how learning occurs in animals.

Process Development

As a result of the activities in this unit, students *observe* animal behaviour under certain environmental conditions, make *comparisons* based on one or two *variables*. They *infer* trends or *predict* effects of changes and carry out simple, systematic *experiments* to test *hypotheses*. In addition, students will learn the need for accurate *measurement* and *data collection*.

Students first *observe* how animals respond to some environmental factors. They *control variables* so that they can *observe* and *collect data* on an animal's behaviour to a change of temperature (page 37), light (page 39) and moisture (page 42). From their observations they make *comparisons*, *inferences* and *predictions*. Students then *investigate* instinctive behaviour by carrying out an *experiment* to see if a student-built bird's nest is as good as a bird's nest (page 46). In the "Finding Out" on page 51, students then set up a mini-environment to *observe* the behaviour of small animals. From their observations they make *comparisons* and they *interpret* the data they collect.

The unit ends with some *investigations* on learned behaviour. Students *observe* and *collect data* on an earthworm's behaviour in a maze, and they make *inferences* from their data (page 56). They then carry out an *experiment* to see if a fish can learn a behaviour from another fish (page 58).

Related Units

Living Things *Orange Book (1)*
Food for Animals and You *Gold Book (2)*
Environment *Gold Book (2)*
Animals and Their Environment *Brown Book (4)*
Small Living Things *Green Book (5)*
Interacting with Your Environment *Red Book (6)*
Ecology: Interaction in the Environment *Exploring Living Things (7)*
Biology: The Study of Living Things *Exploring Living Things (7)*

Materials and Advance Planning

The following list includes the materials that a student, or in some cases a group of students, will need to carry out the activities in this unit. In some instances, other materials may be substituted for those on the list.

2 or 3 goldfish, fish food, small aquarium or large glass jar, clock with a second hand, thermometer, warm and cold water, 6 earthworms, pie plate, aluminum foil, paper towels, tape, mud, twigs, leaves, yarn, newspaper, some vacated birds' nests, small animals such as worms and beetles, wide-mouthed jar and lid, plastic wrap, charcoal, pebbles, sand, small plants, small jar lid, soil, styrofoam tray, clay, index card, flashlights, red, blue and green cellophane.

Set up the goldfish in water that has been aged. Have your students collect earthworms, beetles and other small animals in the schoolground or neighbourhood. You may wish to see if some live small animals are available from a biological supply house. Make provision at the end of the unit to return living things to their environment.

BACKGROUND INFORMATION

Chapter 1: Environment and behaviour, pages 34-43

The chapter introduces the concept of "behaviour." You may wish to discuss and clarify your students' understanding of the word before doing this chapter. Behaviour is always the result of a "cause and effect" relationship. Because of environmental factors or particular situations, living things will "act" or "react" or "function" in certain ways. Some behaviours are controlled and others are uncontrolled. You may wish to use classroom or school behaviour to discuss these aspects of behaviour. A great deal of an animal's behaviour is the result of the animal's responses to its environment. The ability of an animal to respond or adapt to its environment often determines the animal's suitability for surviving in its environment. An animal will respond to environmental factors such as temperature, light, water, air, terrain and sound. For example, some birds and lizards respond to high temperatures by remaining dormant until the temperature drops. Bats respond to reflected sounds in order to avoid obstacles when flying and to locate prey. Certain insects, especially moths, respond to light to find their way. It is for this reason that moths are attracted to artificial lights at night. Other living things in the animal's environment, such as other animals or vegetation, may also affect its behaviour.

Chapter 2: Instincts of animals, pages 44-52

The instinctive behaviour animals display is not learned. Instincts are passed from the parents to their young through *genes*, which are factors within cells that determine the traits with which an animal is born. Sometimes instincts are much more rigidly determined than many of the more superficial traits of colour or shape. A specific stimulus will very often evoke a specific response. For example, if young herring gulls in the nest are shown a dummy gull's head, the young gulls will usually beg for food. The strength of the young gulls' responses will depend on the shape of the dummy's beak and on the presence of a spot of colour on the beak. The young gulls will show the strongest response when the spot is red. If there is no spot, the response is weak.

Preservation of the species and self-preservation are probably the strongest instincts in animals. These can often be seen in the reproductive and protective behaviour of animals. Many species of fish display interesting instinctive, reproductive behaviours. The stickleback fish, for example, will migrate to warm, shallow, fresh water at a certain time of the year to select their breeding territory. The male builds a nest and defends his territory against other males. He tries to attract a female by the red colouration on the underside of his body and by a mating dance. The attracted female is led to the nest, where she lays her eggs. The male then fertilizes the eggs. He will help care for the eggs by fanning them with his fins. This action brings fresh, oxygenated water to the developing embryos.

Another fascinating example of instinctive, reproductive behaviour is displayed by salmon. Salmon eggs are laid in rivers under very specific conditions. After spending about two years in fresh water, the salmon swim out to sea. About four years later, they go back to the river where they were born to lay their eggs. This reproductive act is the culminating act in the life of the salmon. The gruelling journey to the spawning area and the fresh water result in the death of the adult salmon.

The textbook offers other examples of instinctive behaviours displayed by animals for obtaining food, for making shelter, for protection, for reproduction, or for migrating from one place to another. You may wish to have your students research these, and other instinctive behaviours not mentioned in the textbook, more fully. The concepts that you may wish to stress are: that some behaviours of living things are passed on from parents to their young, that preservation of the species is a strong instinctive behaviour in living things and that we all have a role to play in helping maintain and preserve living things.

Chapter 3: Animals can learn, too!, pages 53-59

This chapter develops the concept of "learning"—the ability to find out how to do things that could not be done before or the ability to know about things that were not known about before. Most animals display some form of learned behaviour. The level of learned behaviour an animal displays is dependent on the complexity of the animal's nervous system. For example, earthworms have a very simple nervous system and the tasks that they are able to learn are simple. Dogs and cats, on the other hand, have a more complex nervous system, and are able to learn more complex tasks than are earthworms.

A classic experiment on learned behaviour by animals was carried out in the early 1900's by Ivan Pavlov, a Russian physiologist. Pavlov taught dogs to associate the sound of a bell with the presence of food, thus causing dogs to salivate when hearing the bell. Pavlov's experiment involved placing the food in the dog's mouth while at the same time ringing a bell. After repeating these procedures several times, Pavlov was able to cause the dog to salivate without the presence of food, by merely ringing the bell. Learning of this kind is known as a *conditioned reflex*. There are a number of ways in which animals may learn. One way is by imitation. This involves the animal watching and copying what other animals do. A lion cub being taught to hunt for food and a young bird imitating older birds in learning to fly.

Animals also learn by trial and error. For example, a rat may be placed in a cage where food can be obtained by pushing a lever. While moving about the cage, the rat

may push the lever by accident and receive some food. In time, the rat will discover that it can obtain food by pushing the lever.

Another way that animals learn is through association. Learning through association is learning one thing because of another experience. For example, a dog that was almost hit by a car on a street may learn never to run into the street. The level of learning that occurs is usually the result of repetition. For example, a young bird does not fly the first time it tries to fly. Instead, the bird must repeat the experience a few times before it is actually flying.

Problem-solving is the most sophisticated form of learning. For years, people thought that only they had the capacity to solve problems. There is now evidence that certain animals are also capable of a degree of problem solving. The sea otter may use a rock to break open abalone shells for food. Chimpanzees have solved the problem of getting termites out of a termite nest by placing a branch of a tree into the nest. The termites cling to the branch, and so when the branch is removed, the chimpanzees are able to eat the termites off the stick.

These ways of learning can be illustrated further by giving examples of how students learn at school.

TEACHING STRATEGIES

The purpose of the following activities and teaching strategies is to provide you, the teacher, with a wide variety of suggestions that can be used, together with the material presented in the textbook, to help guide your students in developing the processes and concepts of this unit.

Chapter 1: Environment and behaviour, pages 34-43

— The information on page 34 can be read and discussed.
— It would be helpful to discuss the meanings of the words "behaviour" and "environment".
— The children could suggest a number of different kinds of environments. (e.g. water, desert, above ground, under ground, zoos)
— Different kinds of animal behaviour could be discussed and listed on the blackboard (e.g. a dog barks if he hears noises outside, an opossum plays dead when an enemy approaches)
— Students could go to the library and *research* information related to "What Do They Do?, Activity Card 1".

Heat and Behaviour

— The information on page 35 can be read and discussed.
— The students could conduct the *experiment* in the Teacher's Guide (page 35) to show how heat and cold affect beetles. *Observations* can be recorded on "Beetles, Worksheet 1".
— The information on page 36 can be read and discussed.
— In an area where ice-fishing is conducted in winter, these questions could be asked:
  (a) What kinds of fish are caught?
  (b) At what depth must you drop your line to catch the fish?
  (c) Are the same kinds of fish caught at that depth in summer?
— The students would enjoy conducting the "Finding Out" experiment on page 37. Their findings can be recorded on "The Goldfish Bowl, Worksheet 2".
— The following questions could be discussed:
  (a) What other animals change their environment and behaviour when cold weather arrives? (e.g. bears hibernate, birds fly south, groundhogs go into burrows)
  (b) Does their activity slow down in the new location? (Not always)
  (c) In what way does their activity change?
— Students enjoy dramatizing skits portraying animals. "Just Monkeying Around, Activity Cards 2.01-2.19" are suitable for mime, puppetry or acting. The descriptions could be cut out and pasted on brightly coloured cards so that the students can choose their own activity OR the sheets themselves could be pinned to the bulletin board for perusal. Another class could be invited to see the skits.
  When you introduce this activity you could remind the students that they should:
  (a) think about the kind of behaviour of the animal and/or person
  (b) try to show how the animal will behave in the situation described
  (c) utilize space to advantage
  Other items to consider: sound effects, music, costumes and scenery.
— To develop *critical thinking skills*, students could complete "Life in a Zoo, Activity Card 3".
— At this point, *enrichment* activities could be offered. See "Extending My Knowledge, Activity Card 4".

Light and Behaviour

— The information on pages 38 and 39 can be read and discussed.
— Students can *brainstorm* with the teacher about the kinds of animals that behave in certain ways at:
  (a) sunrise (roosters crow, other birds sing)
  (b) night (cockroaches, bats)
  This information can be represented in pictorial form in their notebooks.
— The students could conduct the "Finding Out" experiment (page 39). "Earthworms and Light, Worksheet 3" can accompany this experiment.
— Students could go to the science centre for a *discovery* session. You could set up a folded, coloured display card with "Secret Information" and "In the Dark", Activity Cards 5 and 6.

— "Watching Eyes" (page 40) can be discussed.

Water and Behaviour

— The information on pages 40-43 can be read and discussed.
— If your school is near a creek or beach, you may wish to *observe* an animal's behaviour in its natural environment. Encourage the children to seek and examine animals but
  (a) proceed carefully so as not to destroy or damage their environment
  (b) return any specimens to the same location.
— The chapter concepts can be reviewed. "A Second Look" (page 43) is offered on Worksheet 4 for this purpose.

Chapter 2: Instincts of animals, pages 44-52

— The information on pages 44-47 can be read and discussed.
— Students could collect vacated birds' nests. "Bird's Nests, Activity Card 7" can be used to *collect data* re: shape, materials used, possible species of bird, etc. The nests should be labelled A, B, C, etc. for easy identification.
— The information on page 48 can be read and discussed.
— If your school is near a trout or salmon hatchery, the class could visit the hatchery. Films about fish hatcheries and migration of fish could enrich this section.
— The students can read "Birds Buzz Off" (page 49).
— It would be exciting to have resource persons from your community visit the classroom, (e.g. conservation officers, naturalists from National Parks) to explain their roles. Possible government offices to call:
  Federal — Environment, Environment Protection Service, Fisheries and Oceans.
  Provincial and Municipal — These departments will vary. Listings under "Government" in your telephone book may give you information.

Living Together

— The reading material and questions can be discussed on pages 50-52.
— Students would enjoy visiting the library and *researching* how families live together. See "Living Together, Activity Card 8".
— The "Finding Out" activity (page 51) is accompanied by "Watching Small Animals, Worksheet 5".
— You may wish to review the concepts of this section by using "A Second Look (page 52), Worksheet 6".

Chapter 3: Animals can learn too!, pages 53-59

What the senses, nerves and brain do

— Pages 53 and 54 can be read to the class.
— The children would enjoy sharing stories about tricks that their pets have learned.
— This statement could be considered: "You can't teach an old dog new tricks".
— Students could observe the behaviour of their own pet or of a friend's pet. "Pets Do Strange Things, Activity Card 9" can be completed. Their findings can be shared with the class.

How Animals Learn

— "My Pet Knows What I Mean When I Say ..., Activity Card 10": Students can draw a picture of their pet and complete the conversation circles with phrases that their pet recognizes.
— It would be helpful to read pages 56-7 before conducting the "Finding Out" activity (page 56). "Finding My Way Home, Worksheet 7" is available for this experiment.
— Students could perform the "Finding Out" (page 58). Two volunteers can tap the dish and feed the fish each day while the class *observes* the fishes' behaviour. The observed behaviour can be *recorded* on "A Fishy Activity, Worksheet 8". "A Second Look (page 59), Worksheet 9" is available for reviewing concepts.
— Enrichment Activity: The students would enjoy having a Clever Pets Day. This activity could be held on the playground. Children could have their pet demonstrate a trick that it has learned. It might be necessary:
  (a) to space the pets so that they can sit quietly
  (b) to have all pets on leashes
  (c) to provide a special viewing area for caged pets
  Prizes could be given for the most unusual trick, the most complicated trick, the funniest trick, etc. The prizes could be a can of dog or cat food, a bone, a toy, a box of biscuits, a box of bird seed, a mirror for a bird cage, etc. Every pet entered should receive a ribbon and a nibbling food like a dog biscuit. Have fun!

What DO they DO?

Choose only *two* of these questions. Write your answer in your science notebook, please.

What does an opossum do when it is attacked?

How does a skunk react when it is cornered?

What does a beaver do when bothered?

What do bears do to warn their cubs of danger?

How do squirrels tell us that we have disturbed them?

Animal Behaviour, Activity Card 1

BEETLES

Purpose: To observe how heat and cold affects beetles.

Behaviour of Beetles in the "warm" cup:	
Behaviour of Beetles in the "cool" cup:	

Critical Thinking

Do you think that heat and cold affected the behaviour of the beetles? If so, how?

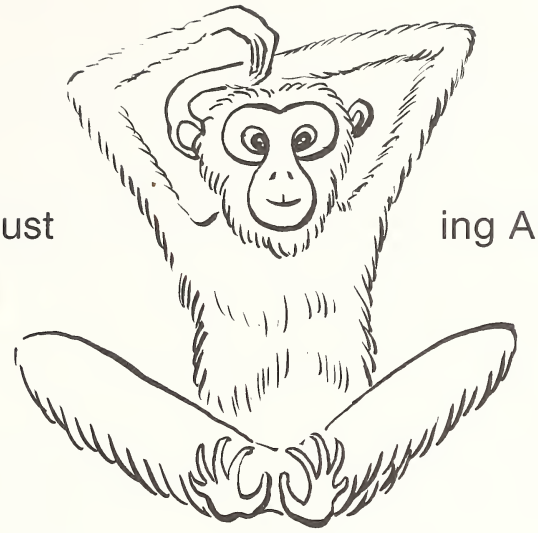
Animal Behaviour, Worksheet 1

The Goldfish Bowl (Page 37)

How does cooling the water change the breathing of the goldfish?

What do you think would happen to the breathing of the goldfish if you made the water warmer than room temperature? Try finding out.

Animal Behaviour, Worksheet 2



Just ing Around

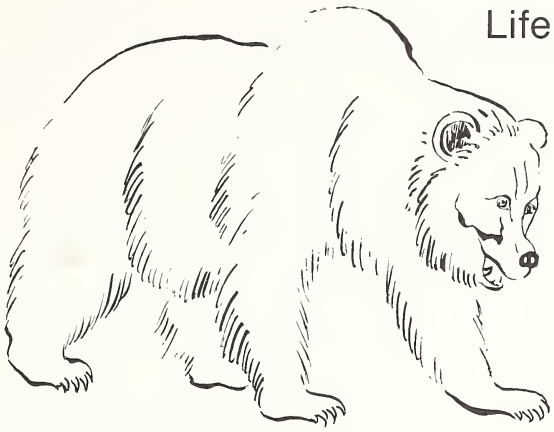
Show your class how you behave in *one* of these skits.
You may need someone to work with you.

You are a trapper. You have checked your last trap. You can hear wolves howling near you! You must go in that direction to get home!	You are in a garden. You come across a nest of baby hummingbirds. You are very excited! Call a friend to join you and watch them. One tries to fly away.
You hear strange noises in a bush. You become curious. You go to the bush and look. It is a little snow monkey who wants to make friends with you!	A blue jay is sitting in the tree. It is chattering away and you decide to talk to it.

You are a giraffe. You wander along and decide to get a drink in a water-hole. But oh, your legs are so long and it is so difficult to make them bend! You do get your drink.	You are a bear and you have just come out of hibernation. You are very hungry. You walk along and find that a family has left their picnic basket on a table. A-ha!!!
You are an opossum. You are walking along a path. Coming from the other way is a fox. You decide that you had better outwit the fox!	You are a snake charmer and your friend is the snake. You play your recorder (or you can whistle). The snake begins to react to your music.
Mr. Redwinkle is tired and decides to leave his dishes on the table until morning. Before he goes to bed, he returns to the kitchen. To his surprise, he finds YOU—the mouse—nibbling on his cookies.	You are a curious robin. You are searching for worms. Oh! Oh! You bump into a bee. The bee becomes a little angry!
You are sitting on a log in the jungle. You get a feeling that something is watching you!	You are walking along the street. A friendly dog called Cinders comes along. Friendly Cinders jumps up, licks your face and then leaps into your arms!

You are walking near a pond. Suddenly a bullfrog croaks. It keeps jumping in front of you as you walk.	You are sitting at a campfire when an owl hoots. You can't see it. You decide to talk to it.
You pick up a stone on a beach and a big snake is lying there!!	You are a snake and someone has broken a stick near you. You decide to slither, glide and slide away from the scene.
You see an injured animal on the road. You know it needs help.	You and your friend are walking along a path. A baby raccoon is sitting near some bushes. It wants someone to look after it.
You are a duck swimming with four young ducklings. One is dawdling and falling too far behind for safety. You think you see a hawk circling above.	You are a snake and it is time to find a sheltered spot for your winter's rest. You find a good spot and you become very sleepy!

Life in a Zoo



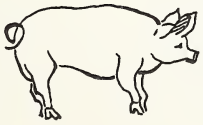
Zookeepers like to have exotic animals in their zoos. They often travel to other countries to obtain different kinds of animals.
It is important that these animals are happy when placed in their new environment.

a) If you were a zookeeper, what would you do to make sure that the animal is happy?

b) What do you think would happen if it was not happy and comfortable?

Animal Behaviour, Activity Card 3

Extending My Knowledge



Choose one activity only:

Find the story *Rikki-tikki-tavi* by Rudyard Kipling. It will likely be in your school or public library. It is a story about a mongoose who saves his master from a cobra. You will enjoy this story.

Ask your librarian to help you to find a book about an animal and how it behaves.

If you have visited a National Park, you may have taken some slides or pictures. Your classmates would enjoy these pictures, especially if you tell them how the animals behaved.

Read the novel *Charlotte's Web*. Draw a picture showing two of the characters in their environment.

Animal Behaviour, Activity Card 4

Earthworms and Light (Page 39)

Where do the worms go?

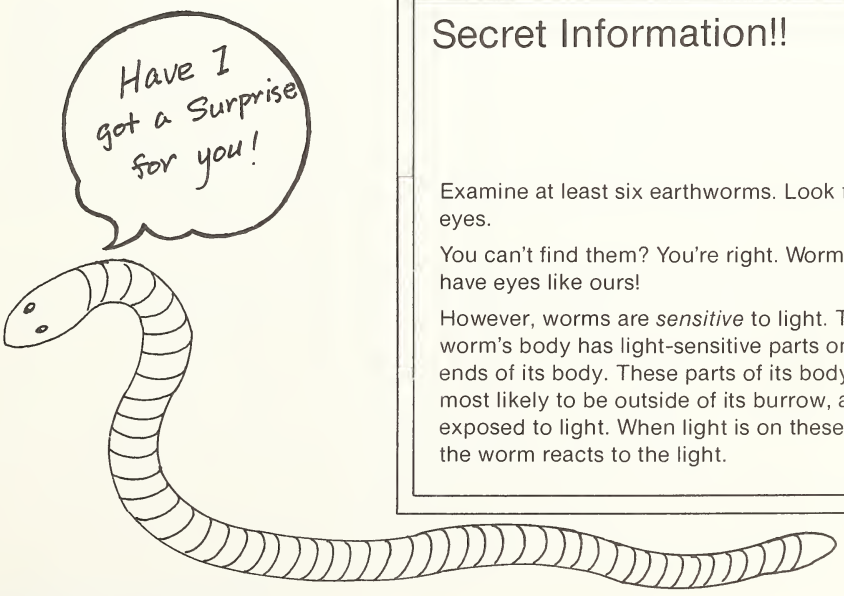
Why?

Write down the number of worms that move toward light. _____

Write the number of worms that do not. _____

If you tried this 3 or 4 times, do you think the worms would do the same thing? Try finding out.

Animal Behaviour, Worksheet 3



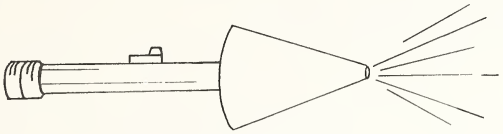
Secret Information!!

Examine at least six earthworms. Look for their eyes.

You can't find them? You're right. Worms don't have eyes like ours!

However, worms are *sensitive* to light. The worm's body has light-sensitive parts on the ends of its body. These parts of its body are most likely to be outside of its burrow, and exposed to light. When light is on these parts, the worm reacts to the light.

Animal Behaviour, Activity Card 5



In the Dark!!

You will need: a box
3 cones (the type used for drinking cups)
3 flashlights
A piece of green, red and blue cellophane
3 elastics
damp newspapers
an earthworm

Cover each flashlight with a different colour of cellophane. Snip off the pointed end of the cone. Place the cone over the cellophane end of the flashlight.

Place an earthworm on a damp piece of newspaper. Cover it with the box. Leave your earthworm for an hour.

After one hour—Darken the room.
Remove the box.
Quickly flash the blue flashlight on the worm's head.
Observe its behaviour.
On the form below, beside "blue flashlight", record what you saw happen.

Cover the worm again. Leave it for an hour. Try the experiement again using the green flashlight. Observe its behaviour and record what you saw.

Again, cover the earthworm and leave it for an hour. Use the red flashlight this time. Observe. Record what you saw.

What happened when you used:

Blue flashlight?	
Green flashlight?	
Red flashlight?	

Which colour of light produced the most activity?

Focus the light on other parts of its body. Does the earthworm behave the same way?

Animal Behaviour, Activity Card 6.

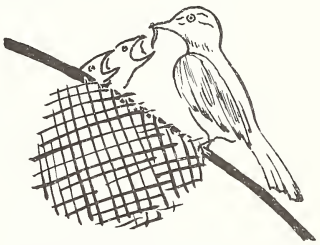
A SECOND LOOK (Page 43)

What is meant by animal behaviour?

What are some things around an animal that may make it behave as it does?

Animal Behaviour, Worksheet 4

Birds' Nests



Purpose: To study different kinds of birds' nests

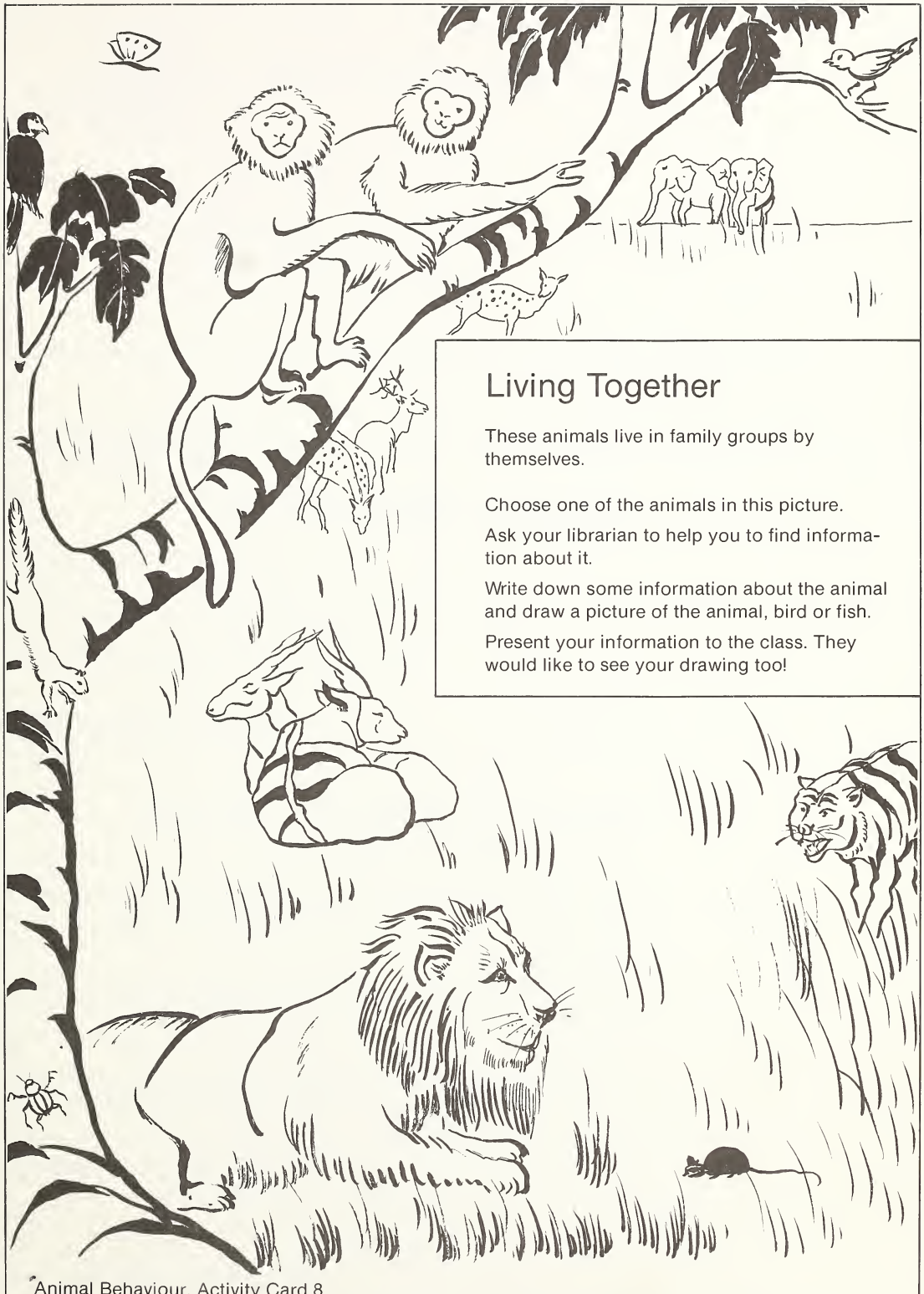
Data to be Collected	Nest A	Nest B	Nest C
Species of Bird			
Shape of Nest (round, long)			
Materials used by bird			

Do any of the nests look alike?

If so, explain why you think they are alike.

If not alike, give some reason why you think they are different.

Animal Behaviour, Activity Card 7



Living Together

These animals live in family groups by themselves.

Choose one of the animals in this picture.

Ask your librarian to help you to find information about it.

Write down some information about the animal and draw a picture of the animal, bird or fish.

Present your information to the class. They would like to see your drawing too!

Animal Behaviour, Activity Card 8

Watching Small Animals (Page 51)

Which animals like to get under things?

Which animals like to move about?

What other kinds of animal behaviour do you see?

Why do you have to know something about an animal's behaviour when keeping it in a jar?

Animal Behaviour, Worksheet 5

A SECOND LOOK (Page 52)

What is meant by an instinct?

Why are instincts important to animals?

What are some instincts that animals have?

Animal Behaviour, Worksheet 6

Pets Do STRANGE Things!!!!

What happened when you called your pet while it was sleeping?

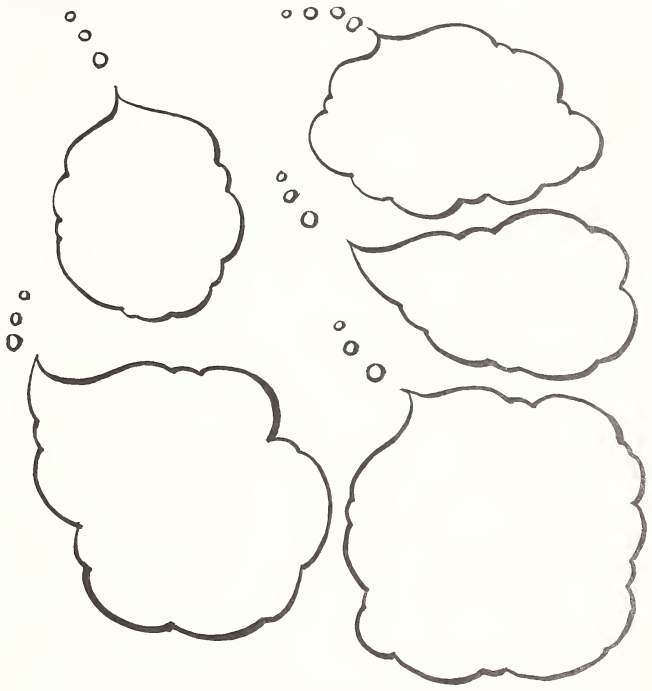
What happened when you stroked the cat gently when it was resting?

What happened when you touched the tip of your pet's ear?

What did your pet do when you touched its paw?

Animal Behaviour, Activity Card 9

My pet knows what I mean when I say …



My pet's picture

Trainer _____

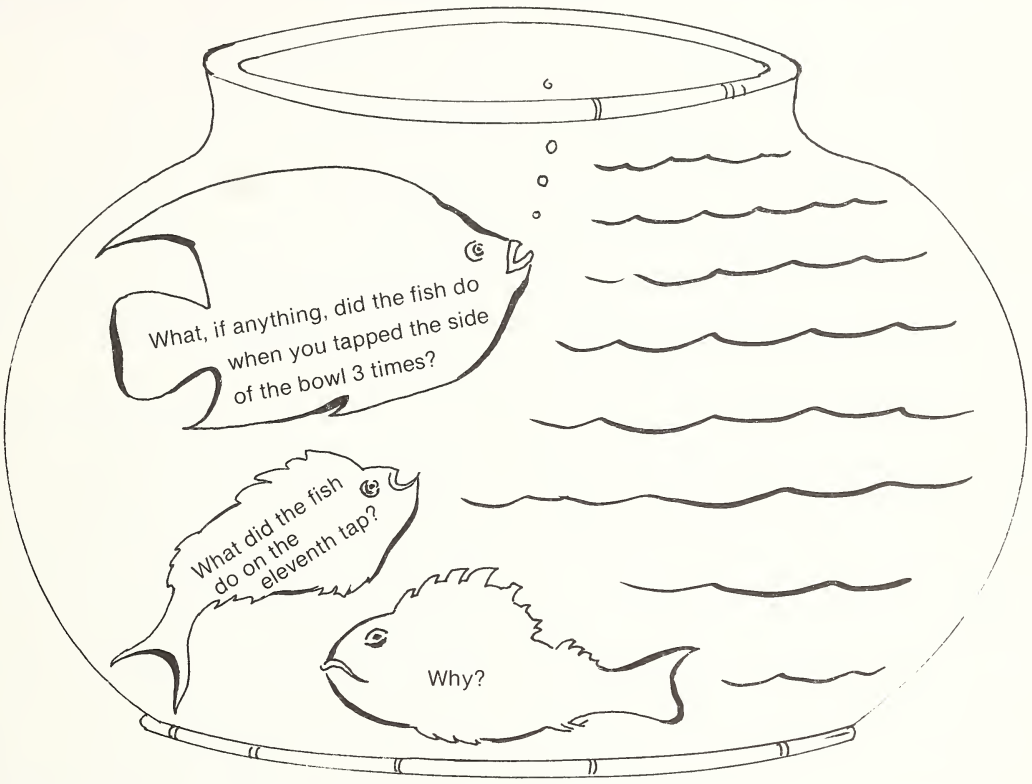
Animal Behaviour, Activity Card 10

FINDING MY WAY HOME (Page 56)

Did your earthworm find its way home? If so, how do you know?

Animal Behaviour, Worksheet 7

FINDING OUT (Page 58) A Fishy Activity



Animal Behaviour, Worksheet 8

A SECOND LOOK (Page 59)

What is learning?

What parts of the body help an animal to learn?

What are some ways animals learn?

Animal Behaviour, Worksheet 9

BLUE BOOK (3)
Unit 3: Heat and Temperature

Pages 64-95

UNIT OVERVIEW

Concept Development

In this unit, students are introduced to the concept of heat as a form of energy—where it comes from; how it can be produced; some of its properties and how the temperature of objects can be measured.

Process Development

Some of the investigations in this unit involve hot objects and burning. It is important to stress safety precautions and to provide adequate adult supervision during these investigations.

The study of "Heat and Temperature" lends itself well to developing the processes of *observing*, *comparing*, *measuring*, *collecting data*, *inferring* and *predicting*. In a number of the "Finding Outs" students are asked to *compare* the temperature of objects using their sense of touch. Concrete experiences using the senses are important in helping students develop concepts, see relationships and develop the vocabulary necessary to describe an experience. However, it is important to develop the concept that people have to rely on instruments for accurate measurement of temperature differences.

In the "Finding Out" (page 67), students make *inferences* about the sun as a source of heat energy by *comparing* the temperature of objects left in a sunny location and in the shade. Students then *observe* and *compare* how heat moves through air (page 74) and what happens to air when it is warmed (page 76). They make *inferences* from their observations. In the "Finding Out" (page 77), students *observe* how heat moves by conduction along a wire. They *infer* that heat will move through other solids in a similar way. This is followed by an investigation on the expansion and contraction of air (page 84).

The unit ends with two "Finding Outs" that develop the concept of "temperature". Students first use their sense of touch to *measure* temperature differences (page 86). Then they use thermometers to *observe*, *predict*, *compare* and *measure* temperatures (page 89).

As a result of these experiences, students should be able to describe and demonstrate some properties and sources of heat energy, and develop some skills in using a thermometer.

Related Units

Solids, Liquids and Gases *Brown Book (4)*
Air and Weather *Brown Book (4)*
Changes in Energy *Red Book (6)*
Energy: For Work and Motion *Exploring Matter and Energy (7)*
Weather: The Changing Atmosphere *Exploring Earth and Space (7)*

Materials and Advance Planning

The following list includes the materials that a student, or in some cases a group of students, will need to carry out the activities in this unit. In some instances, other materials may be substituted for those on the list.

3 or 4 pairs of small things such as rocks, pieces of aluminum foil, cups of water; candle; candleholder; matches; 2 milk cartons; string; 2 metresticks or pieces of wood; electric lamp; coat hanger; 2 empty pop bottles; pan of water; cardboard box; 30 cm by 30 cm corrugated cardboard; pliers; 4 strong elastic bands; aluminum foil; all purpose glue; masking tape; recipe ingredients (for Activity Card 7); a number of different types of thermometers (meat, clinical, freezer, maximum and minimum.)

You may wish to use a stronger heat source than a candle for the "Finding Out" on page 77. A propane torch or an alcohol lamp would be more effective. If there is a secondary school near your school, you may wish to borrow a conductometer to demonstrate conduction.

BACKGROUND INFORMATION

Chapter 1: Where does heat come from? pages 66-72

Heat is the energy of moving molecules (*kinetic energy*). The faster the molecules move, the hotter the object becomes and the more heat energy the object has. There are many sources of heat energy. However, the primary source of heat energy is the sun. Solar or radiant energy is the basis for life on earth. Solar energy is also being used more and more to heat buildings and to produce electricity. Another source of heat energy is the earth. Within the earth is a vast amount of stored energy called *geothermal energy*. This source of heat

energy has great potential to produce electricity or to heat homes.

Another producer of heat energy is electricity. When electricity passes through the wires in an electric toaster, those wires resist the flow of the electric current which causes the wires to become hot. The same principle occurs when electricity passes through the filament in an incandescent light.

Chemical energy is another producer of heat energy. For example, the burning of a fuel, such as oil, gas, coal and wood, is a chemical reaction that produces heat energy. The cells of a person's body cause certain chemical reactions to take place. These chemical reactions provide the body with energy to carry out vital processes and activities.

In addition to solar energy, electricity, geothermal energy and chemical energy, another source of heat energy is nuclear energy. Nuclear energy involves the controlled splitting of certain atoms to produce heat energy.

Heat energy can also be produced by friction which is caused by rubbing two surfaces together.

Chapter 2: How heat moves, pages 73-79

Heat energy can be transferred from one object to another in one of three ways. In liquids and gases, heat is transferred by *convection*. For example, the heat given off by a warm stove warms the air next to the stove. As the air becomes warmer, the molecules move faster and expand. This causes the warm air to become lighter than the air around it and it rises. It is replaced by the cooler air. The same process occurs when heating a pan of cold water. As the water near the bottom of the pan is heated, the warm water rises and is replaced by the cold water near the surface. This movement continues until all the water in the pan is at the same temperature.

Heat travels through solids by *conduction*. As a solid is heated, the molecules closest to the source of heat begin to move faster. They bump into the molecules around them, causing them to move faster, and thus causing the heat energy to be transferred.

Solar energy given off by the sun, travels to the earth by *radiation*. When these waves of radiant energy strike an object, they cause the molecules making up that object to move faster, causing the object to become warmer.

Although the movement of heat energy is essential to life, there are times when the movement of heat is not desirable. For example, during cold weather the loss of heat from buildings is not wanted and during hot weather the addition of heat to buildings is not wanted. Therefore to control the movement of heat in both instances insulation is used. Because heat travels through solids by means of conduction, then using materials that are poor conductors helps prevent the movement of heat. Plastic, wood, fibreglass and air are poor conductors and are therefore good insulators.

Chapter 3: How heat changes things, pages 80-84

In general, heating an object causes it to expand, and cooling an object causes it to contract.

Heat energy can also change the state of an object. For example, when heat energy is added to ice, the ice changes its state and becomes water. Further heating of that water will cause it in turn to change its state and to become water vapour. The process of changing water vapour to water and then to ice is accomplished by taking away (giving off) heat energy.

Sometimes the processes of evaporation (changing water into water vapour) and boiling are confused. A large amount of heat energy is required to make a liquid boil under normal atmospheric pressure. But, it is not necessary for a liquid to boil in order to change its state to a gas. Puddles of rainwater or water in a swimming pool will evaporate without boiling taking place. However, in both instances heat energy is involved.

Chapter 4: Measuring temperatures, pages 85-91

Temperature is a measure of how hot or cold an object is. In a sense, temperature indicates how fast or how slow the molecules in an object are moving. Temperature, however, does not show how much heat energy an object has.

Thermometers are used to record temperature, which is measured in units called degrees. The Celsius scale is used to record temperature in Canada. According to the Celsius scale, water boils at 100°C at sea level and freezes at 0°C at sea level.

The boiling points for liquids change depending upon atmospheric pressure. A lower temperature is needed to boil water at heights greater than sea level, because the atmospheric pressure lessens as you go to higher elevations. Because of this reduction, the boiling point of water at 3000 m is 90°C.

Scientists working with extremely cold temperatures use the Kelvin scale. The Kelvin scale is sometimes called the absolute scale because 0°K, on the Kelvin scale is theoretically the temperature at which the motion of molecules stops. By comparison 0°K on the Kelvin scale would be -273.16°C.

TEACHING STRATEGIES

The purpose of the following activities and teaching strategies is to provide you, the teacher, with a wide variety of suggestions that can be used, together with the material presented in the textbook, to help guide your students in developing the processes and concepts of this unit.

Chapter 1: Where does heat come from?, pages 66-72

— Pages 65 to 67 can be read and discussed.

— The "Finding Out" (page 67) demonstrates the concept that heat comes from the sun. See Worksheet 1.
— A number of picture books and magazines related to solar energy and its uses could be placed in the science centre or reading centre for the students to peruse. Also, they might wish to bring books from home for their friends to share.
— Children could discuss answers to this question: "Why might using the heat from the sun to heat our homes be important to people?" (People need to save fuels such as oil and gas.)
— Small groups could *brainstorm* ways that we use heat from the sun in Canada. (e.g. to dry clothes, to suntan, to dry nets, to grow crops and plants, to get warmth, to bring light, to dry foods, to warm water in swimming pools, to heat buildings, to cook foods, etc.)
— "Sunny and Unsunny Thoughts, Activity Card 1", is available to encourage students to *predict* consequences of situations concerning the sun.
— Students would enjoy making a Solar Hot Dog Cooker. See Activity Card 2. Perhaps a few parent helpers could assist students with the measurements and construction. Students should record (a) the time that the hot dog was placed in the cooker and (b) the time that the hot dog was cooked and taken off the skewer. They can calculate how long it took to cook and, *compare* their cooking times with others. If there are differences, you might wish to have the class discuss possible reasons why.
— Pages 68 to 70 can be read and discussed.
— "What Happened?, Activity Card 3" has been included to reinforce the concept that heat is produced by rubbing or friction. Perhaps students could do two of these activities.
— Page 72 can be read and discussed. Books and magazines could be available in a reading centre to stimulate interest in geysers, volcanoes and hot springs.

The students may wish to bring post cards and brochures on these topics. Perhaps information could be obtained on the following:

Volcanoes	
Mauna Loa	Hawaii
Krakatoa	Sunda Strait
Mont Pelee	Martinique
Mount Etna	Sicily
Mount Fujiyama	Japan
Vesuvius	Italy
Mount St. Helens	U.S.A. (State of Washington)
Mount Hood	U.S.A. (State of Oregon)
Mount Baker	U.S.A. (State of Washington)
Geysers	
Old Faithful	Yellowstone National Park, Wyoming
Hot Springs	Radium, B.C.
	Harrison Lake, B.C.

— "A Second Look (page 72), Worksheet 2" is available for review purposes.

Chapter 2: How heat moves, pages 73-79

— Page 73 can be read and discussed.
— To *demonstrate* that heat moves through objects, students could sit outside quietly with their backs to the sun for 5 to 10 minutes. You could ask the students to make mental notes of what they feel and experience.
— Pages 74 and 75 can be read and discussed.
— "Finding Outs (pages 74 and 76), Worksheets 3 and 4" are available.
— Page 77 can be read.
— In order to perform the "Finding Out" (page 77), it is recommended that you borrow conduction equipment from a high school or use a stronger heat source. Also be sure that the coat hanger does not have a plastic coating. If it does, then remove the coating with sand paper.
— Pages 78 and 79 can be read and discussed.
— "What Am I?, Activity Cards 4-6" provide clues about articles which have been designed to keep heat from moving.
  "I Love Heat—What Am I?"
    Answers: (a) a thermos (b) a sleeping bag (c) hot water tank (d) fur-lined boots or mukluks
  "I Keep Out Heat—What Am I?"
    Answers: (a) a picnic cooler (b) a refrigerator (c) a freezer
  "I Keep Heat in & Out—What Am I?"
    Answers: (a) double pane windows (b) moon or space suit (c) insulation
— "A Second Look (page 79), Worksheet 5" has been included for review purposes.

Chapter 3: How heat changes things, pages 80-84

— Page 80 can be read and discussed.
— Students could collect and display items that have been changed by heat. (e.g. croutons, toast, sun-dried fruits, smoked salmon, canned goods, a cup-cake, hamburger patty, a glass ornament, picture of dry and cracked soil, maple syrup and sugar, etc.) Beside each item, students could *infer* how the item was changed by heat.
— Students would enjoy drawing cartoons using conversation circles to talk about how heat changes things. (e.g. a conversation between two icicles or two snowmen, an apple about to be baked, a raisin in the sun.)
— "Science in the Kitchen, Activity Card 7" reinforces the concepts that (a) heat melts things and (b) heat can change things.
— Pages 82 and 83 can be read and discussed.
— Worksheets 6 and 7 for "Finding Out (Page 84)", and "A Second Look (page 84)" are available.

Chapter 4: Measuring temperature, pages 85-91

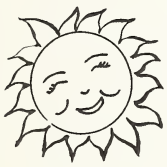
— Page 85-88 can be read and discussed.
— Worksheets 8 and 9 for "Finding Out" on pages 86 and 89 are available.
— Activity cards 8 and 9 entitled "Outside" and "Inside" can be used for students to *collect data*, graph data and *draw inferences* related to indoor and outdoor temperatures. Your school may have indoor and outdoor thermometers in use—if so, these can be used.
— An awareness of the use of the thermostat could be developed through discussion. Some of these questions could be posed:
  — Why do we have a thermostat in our classroom or homes?
  — Why do you think they placed the thermostat where they did?
  — Where is the thermostat located in your house? Why do you think they placed it there?
  — Would it be wise to place a thermostat beside a door? Why or why not?
  — What happens if the temperature of the room is below the temperature set on the thermostat? Above that set on the thermostat?
  — Could we use one thermostat for the whole school? Explain.
— Page 90 can be read and discussed. Students could examine types of thermometers on display in the science centre. (e.g. candy thermometers, oral thermometer, meat thermometer, freezer thermometer, pool thermometer, etc.) How are they alike? Different?
— "A Second Look (page 91), Worksheet 10" is available for review purposes.

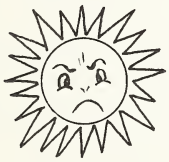
FINDING OUT (Page 67)

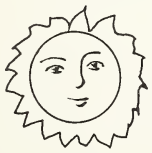
Which things are warmer—the ones in the sunlight or the ones in the shade?

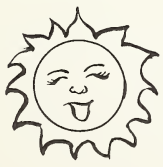
Why?

Heat and Temperature, Worksheet 1









Sunny and Unsunny Thoughts

Suppose we had a day without sun. What would we do differently?

What would happen if the sun disappeared?

Can you think of 3 ways that we can use solar energy?

Name some colours in clothes that will keep you cool on a sunny day.

"Solar energy is the cleanest kind of energy." What does this mean?

Heat and Temperature, Activity Card 1

SOLAR

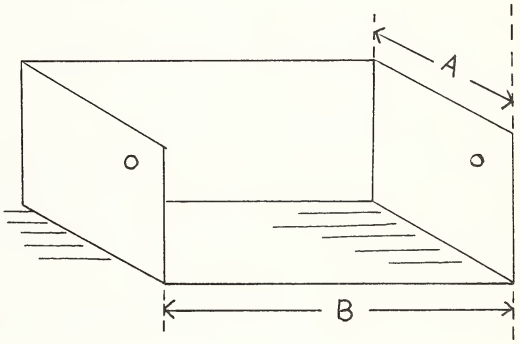
Hot Dog Cooker

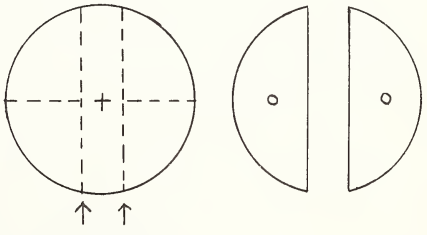
You will need:

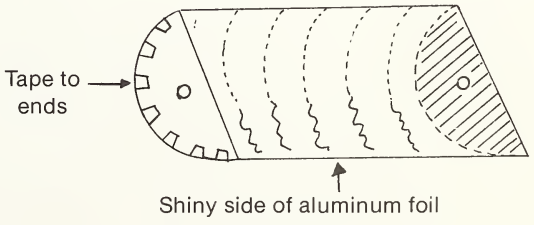
- a cardboard box
- corrugated cardboard
- a coat hanger
- a pair of pliers
- 4 strong elastic bands
- aluminum foil
- Manilla tag
- all-purpose glue
- tape
- scissors
- a hot dog!

1. Cut the top and front out of a cardboard box to make a holder for the solar cooker.
2. Draw a circle on a piece of corrugated cardboard with a radius equal to "A" in the picture above.
3. Mark the centre of the circle with a dot. Divide the area between the left side of the circle and the dot into 4 equal sections. Do the same with the section from the dot to the right side of circle.

   Draw a line through the first dots you have marked to the left and right of the centre. Cut along these lines.
4. Make a small hole in the centre of each half just big enough to slip the coat hanger wire through.
5. Cut a piece of manilla tag slightly shorter than distance "B". See the first drawing. This forms the curved back of your hot dog cooker. Glue your aluminum foil to one side with the shiny side OUT.
6. Tape the foil-covered back to the two curved ends made in Step 3.

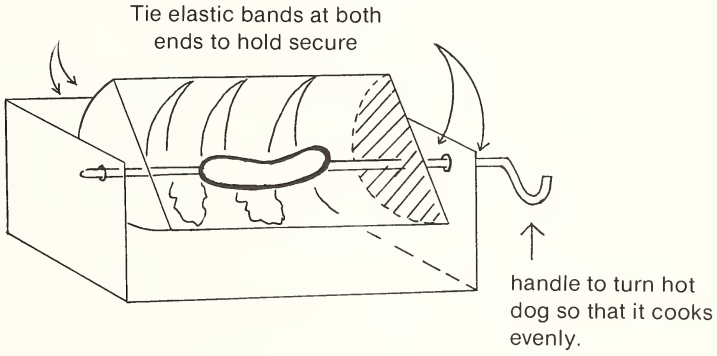






....continued

7. With pliers, cut and straighten the coat hanger. Bend one end to make a handle which you can turn easily. (See picture below.)
8. Push the straightened coat hanger through the one end of the box and curved reflector, the hot dog, the other end of the curved reflector and the box. (See picture below.) Use the elastic bands to keep the reflector and the coat hanger from slipping when you turn the handle. (The elastic bands will have to be cut, in order to wrap them around the hanger, and then tied.)
9. Angle your cooker toward the sun. Make sure you find the best position so that the sun's heat energy is reflected on the hot dog. You may have to experiment a little to find the right angle.
10. When your hot dog is cooked—you can eat it!



What happened???

Try *two* of these activities.

1. Hammer a nail on a piece of flat stone. Feel the nail.

   Is it hot? _____ Is the hammer hot? _____

   What do you think caused the nail to get hot? _____

   _____

2. Before you go for a ride in your car—feel the tread on the tires.

   When the car stops, feel the tread again.

   Was it hot before you left? _____ Was it hot when you arrived? _____

   Explain why you think this happened. _____

   _____

3. Someone at home may be drilling holes in some wood. Before they begin to make the holes, feel the drill bit.

   When they finish drilling a hole, carefully feel the drill bit again.

   Was the drill bit cold before starting? _____

   Explain what happened. _____

   _____

   Explain why. _____

   _____

4. Think back to a time when you slid quickly down a rope.

   What happened to your hands? _____

   _____

   What do you think caused this? _____

   _____

5. Rub two blocks of wood together. Feel the surfaces of the wood that you rubbed together.

   What do you feel? _____

   _____

   Why did this happen? _____

   _____

Heat and Temperature, Activity Card 3

A SECOND LOOK (Page 72)

What are some ways in which heat is important?

How can you make heat with your hands?

What are volcanoes and geysers?

Heat and Temperature, Worksheet 2

FINDING OUT (Page 74)

Where did you feel the most heat?

Why?

Heat and Temperature, Worksheet 3

FINDING OUT (Page 76)

Do the cartons still balance?

If not, which carton moves up?

Why?

Heat and Temperature, Worksheet 4

A SECOND LOOK (Page 79)

How do warm air and cool air move in a room?

What are some objects heat can move through?

When might you want to keep heat from moving?

Heat and Temperature, Worksheet 5

What Am I?

(a) I'm sometimes short,
Sometimes tall.
I appear at lunch
And warm you in fall.
What Am I?

_____

(b) I'm long but can become oh so small,
I'm used by the short, medium or tall.
I'm light for campers
But my warmth will pamper.
What Am I?

_____

(c) Soap and I go together,
In all kinds of weather.
You'll most likely find
me in your basement.
What Am I?

_____

(d) In the chilly north
With the Inuit and trappers I go too;
You might think of me like a shoe.
What Am I?

_____

Heat and Temperature, Activity Card 4

What Am I?

(a) I come in all sizes and fit
into a car,
I'm taken on picnics,
Regardless how far,
What Am I?

_____

(b) I hold packages and dishes
in all kinds of sizes,
When you peak in—you might
find some surprises!
I save you money by keeping it
cool.
What Am I?

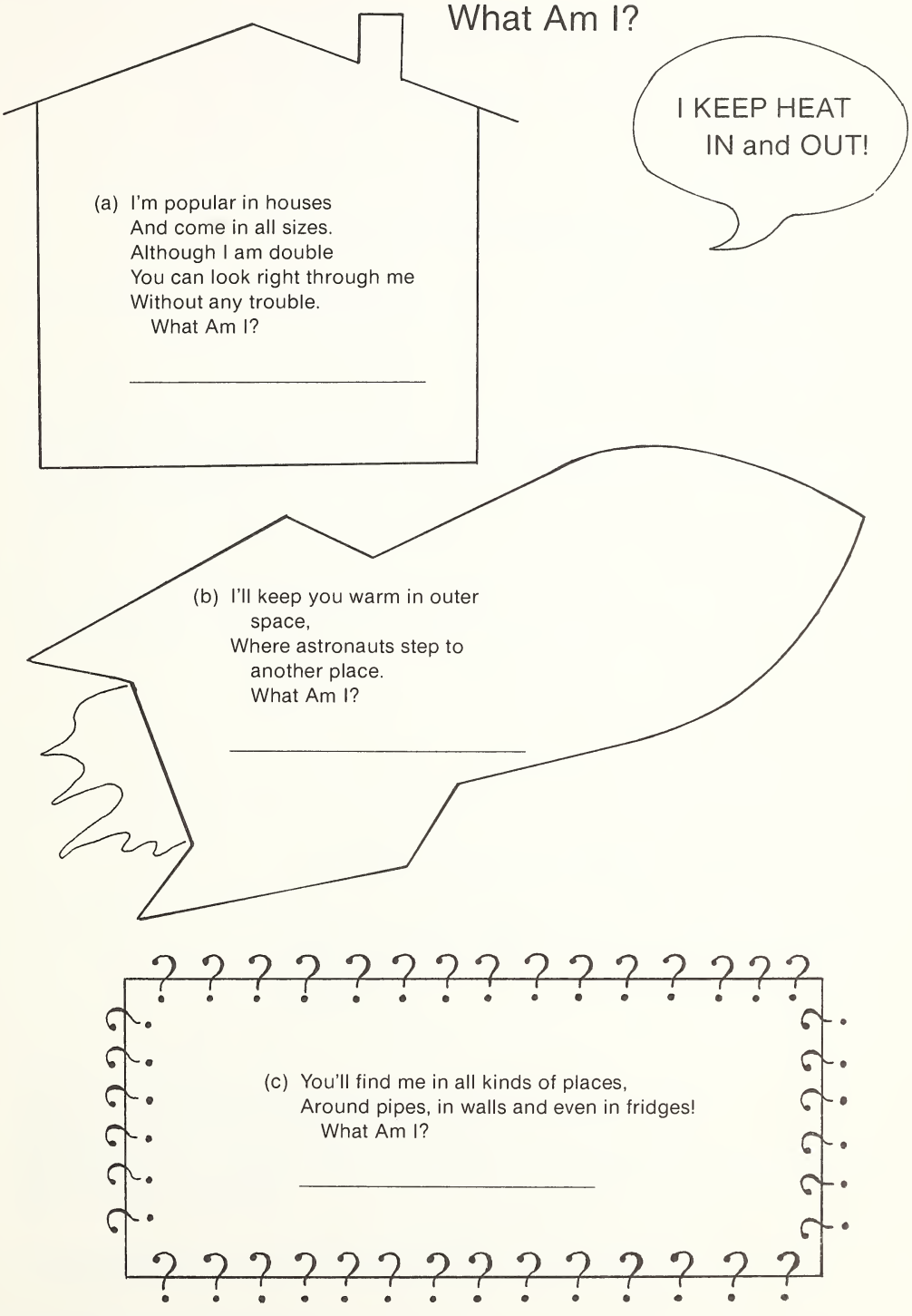
_____

(c) When you open me up
You'll hear Mother shout.
"Please close the lid and keep the heat out!"
What Am I?

_____

Heat and Temperature, Activity Card 5

What Am I?



Heat and Temperature, Activity Card 6

Science in the Kitchen?

Yes! When we cook food,
heat changes it!
Find out how it is changed. Try these yummy foods!

PRUNES WITH BACON

You will need:

- 28 pitted prunes
- 14 slices of bacon
- 28 toothpicks
- Cookie sheet
- A knife
- Pair of oven mitts

Soak the prunes in warm water for 2 hours. Drain and dry.
Cut the bacon slices in half. Preheat the oven to 210° C.
Wrap each prune in half of a bacon slice. Push a toothpick into the bacon slice and prune.
Cook in the oven 210° C until the bacon is done.
Serve hot.

What happened to the prune in the warm water?

What happened to the bacon when it was heated in the oven?

STUFFED MUSHROOMS

You will need:

- 1 or 2 cans of whole mushrooms
- container of smoky-cheese spread
- Butter or margarine
- A knife
- A cookie sheet
- A paper towel
- Pair of oven mitts

Turn on the broiler.
Open a can of mushrooms. Drain off the liquid.
Place the mushrooms on a paper towel to dry. Remove the stems, if any.
Fill each cap with a dab of smoky-cheese spread.
Dot with butter or margarine. Place the mushroom caps (cheese side up) on the cookie sheet.
Broil 1 minute or until hot.

What happened to the cheese and margarine when it was broiled?

FINDING OUT (Page 84)

What happens to the air in each balloon?

Why?

Heat and Temperature, Worksheet 6

A SECOND LOOK (Page 84)

In what ways does heat change things?

How does ice change when it melts?

How does water change when it boils?

Heat and Temperature, Worksheet 7

FINDING OUT (Page 86)

Does the water in the third pan feel the same to both hands?

If not, which hand feels warm?

Why?

Which hand feels cool?

Why?

Heat and Temperature, Worksheet 8

.... Outside

Read the temperature on the thermometer—outside your school—at the times listed on the chart below. Record the temperature on the chart.

TIME OF DAY	TEMPERATURE		
	Day 1	Day 2	Day 3
08:30 hours			
Recess			
12:00 hours			
13:00 hours			
15:00 hours			

Did the temperature change during the day?

Why do you think so?

Circle the coldest temperature and the warmest temperature on your chart. Can you explain these two temperature readings?

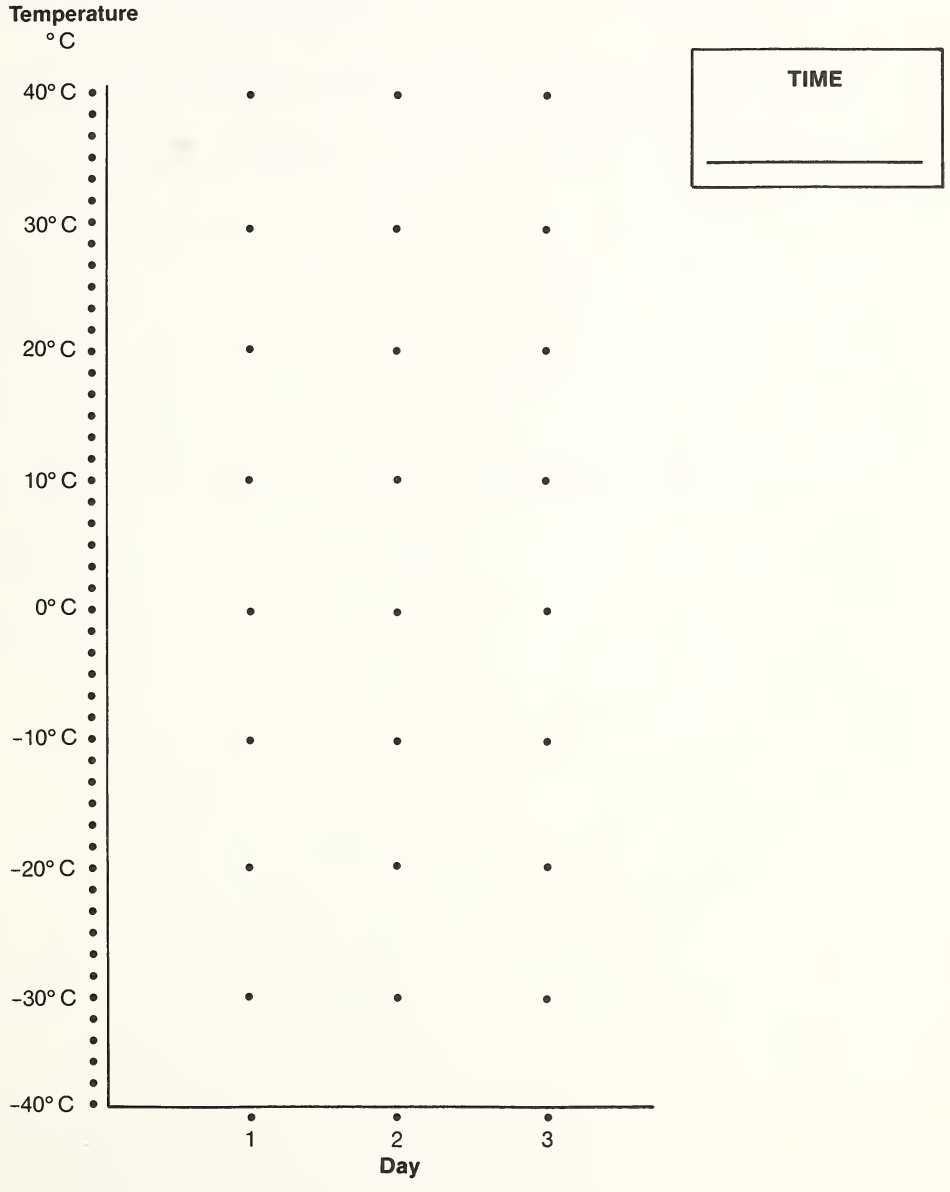
Make a graph to show the temperature each day for one of the above times. You can use the graph on the next page.

Were the temperatures different each day at that time?

Why do you think so?

Heat and Temperature, Activity Card 8

Graph for [____] .... OUTSIDE



Heat and Temperature, Activity Card 8 (cont.)

Inside

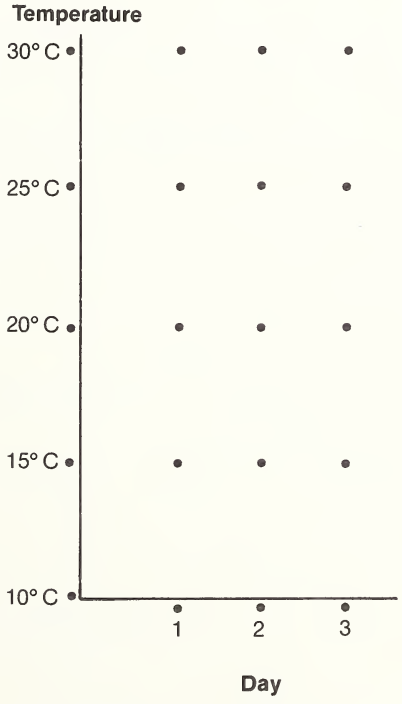
Read the temperature on the thermometer in the classroom at the times listed on the chart below. Record the temperature on the chart.

TIME OF DAY	TEMPERATURE		
	Day 1	Day 2	Day 3
08:30 hours			
Recess			
12:00 hours			
13:00 hours			
15:00 hours			

Make a graph to show the temperature each day for *one* of the above times.

TIME

_____



Were the temperatures different each day at that time?

If so, why?

Heat and Temperature, Activity Card 9

FINDING OUT (Page 89)

How did each thermometer change?

Which one shows the highest temperature?

Why?

Which one show the lowest temperature?

Why?

How close were your guesses?

Heat and Temperature, Worksheet 9

A SECOND LOOK (Page 91)

Why is feeling something with your hands not the best way to measure its temperature?

What does the temperature of something tell you?

What is the best way to measure temperature?

Heat and Temperature, Worksheet 10

BLUE BOOK (3)
Unit 4: Sounds Around You

Pages 96-127

UNIT OVERVIEW

Concept Development

In the preceding levels of the program, the following concepts were introduced and developed:

Sound energy makes up part of the environment. Sound helps us sense and find out a great deal about our environment. Some properties of sound are: loud, soft, high, and low. Sound has many uses.

The following concepts are developed in this unit: Sound is a form of energy that is transmitted by wave motion. Sound is produced by objects vibrating. The pitch of a sound is dependent on the speed (frequency) of vibrations. The loudness of a sound is dependent on the amount of energy that the vibrating object has. Loudness also decreases with distance away from the source of the sound. Sound waves travel in all directions, through different objects, and can be reflected off objects. Animals have developed different ways of making sounds and receiving sounds. In humans, sounds are produced when the vocal chords vibrate in the larynx. Sounds are received through the three main parts of the human ear before being transmitted by a nerve to the brain.

There are two concepts that might be difficult for children of this age to grasp: that sounds are caused by vibrations and that sound energy can move through objects without actually causing the object to move with the sound waves. Wherever possible, use visible examples to illustrate these two concepts. For example, vibrating elastic bands demonstrate that sounds are caused by vibrations.

An additional concept that you may wish to develop in this unit, is that if sounds are unnecessarily loud, or have a bad effect on our health, work or play, then these sounds are a form of pollution. We all have a responsibility to help control noise pollution.

Unit 4, "Sounds Around You", is made up of four chapters. Chapter one outlines the similarities of sounds. The process of hearing is discussed in chapter two. The third chapter points out why sounds differ from one another. In chapter four, the way that animals make and receive sounds is discussed.

Process Development

In the "Finding Out" activities, students first *investigate* how a sound is made by *observing* a vibrating ruler (page 100). They then make *inferences* on how vocal chords make sound by *observing* how sounds can be emitted from the mouth of a balloon (page 102).

In the "Finding Out" on page 103, students *observe* that the sound of a clanging spoon can be heard from any place in a room. From this observation, students arrive at the *hypothesis* that sounds can travel in all directions. Students then construct a string telephone (page 105). After using their string telephones, students will *infer* that their voices reached their partner's ear by travelling through the string, and they can make the generalization that sound travels through different objects.

Students *investigate* how sounds are received by their ears (page 110). They control a *variable* by listening with one ear or two ears. Then they *collect data* to *compare* their listening ability using one ear or two ears.

Frequency and pitch are *investigated* by using rubber bands (page 113) and pop bottles (page 117). The students *observe* that the tighter the rubber band or the smaller the amount of air space in the bottle, the higher the sound produced will be. They are then able to *infer* from their *observations* that the greater the frequency of the sound wave, the higher the pitch of the sound will be. They use the results of these investigations to *predict* whether a sound will be high or low.

Related Units

Your Senses *Orange Book (1)*
Environment *Gold Book (2)*
Interacting with Your Environment *Red Book (6)*
Changes in Energy *Red Book (6)*
The Human Body: A Study of Yourself *Exploring Living Things (7)*

Materials and Advance Planning

The following list includes the materials that a student, or in some cases a group of students, will need to carry out the activities in this unit. In some instances, other materials may be substituted for those on the list.

Wooden ruler or similar piece of wood, tuning fork, balloons, 2 metal spoons, string, 2 paper cups, 16 hard objects such as pencils or tin cans, rubber bands (8 of various widths), 8 empty pop bottles (same size), funnel, container of water, 8 straws at least 21 cm long, cigar

box (or small cardboard or plastic container) piece of dowel (10 cm), piece of wood (35 cm by 8 cm), small wedge of wood, copper tubing (13 mm wide and 130 cm long), hand drill, hacksaw, keyhole saw, file, heavy string, tape recorder.

You may wish to pre-cut the wood and copper tubing required for the simple guitar and xylophone.

BACKGROUND INFORMATION

Chapter 1: How are sounds alike?, pages 98-105

The chapter introduces the concept that all sounds are similar in the way that they are produced and in the way that they travel. In order that a sound can be made, an object or part of an object must be vibrating. Once a sound is made, it is transmitted by wave action. The sound travels in all directions. Sound waves continue to move outwards until they strike an object and either stop, or cause that object to vibrate. Sound waves can travel through liquids, solids and gases. In fact, sound waves travel faster through solids and liquids than through air. For example, sound waves travel through air at approximately 331 m/s. They travel through water at approximately 1430 m/s, and through steel at approximately 5000 m/s. The reason for this difference in speed is that the molecules in liquids and in solids are much closer together than in gases. As a result, the sound waves travel from one molecule to the next more quickly in solids and liquids than they do in gases. Sound waves cannot travel through a vacuum, as there are no molecules in a vacuum that can vibrate.

Chapter 2: Hearing sounds, pages 106-110

The sense of hearing involves sound waves being received by the ear and then transmitted by nerves to the brain, for interpretation. The outer ear is shaped like a funnel that enables sounds to be caught and directed along the ear canal to the eardrum, or *tympanic membrane*. As sound waves strike the eardrum it vibrates. These vibrations are transmitted to three bones in the middle ear, called the hammer (*malleus*), anvil (*incus*) and stirrup (*stapes*). As the stirrup vibrates, it moves in and out of a small oval opening which leads into the inner ear, or *cochlea*. Within the cochlea is a thick fluid, and the true organ of hearing, the *organ of Corti*. The organ of Corti has numerous nerve cells, which change the sound waves into nerve impulses. These travel along the auditory nerve to the brain, which in turn interprets the impulses.

Two ears are helpful when trying to determine the direction of a sound. For example, if a sound comes from a person's left, the sound waves will reach the person's left ear before they reach the right ear. The nerve impulses within the left ear thus reach the brain before the nerve impulses from the right ear. The brain picks up that difference in time, and enables the person to know that the sound came from the left.

Chapter 3: High and low sounds, pages 111-118

In this chapter, the concepts of "frequency", "pitch" and "intensity" are developed. Pitch is controlled by the tightness or by the size of the vibrating object. For example, the tighter a string is, or the smaller an object is, the higher will be the sound that it makes when vibrating.

Frequency is the speed at which sound waves vibrate. The faster the sound waves vibrate, the higher the frequency will be at which these sound waves are vibrating. People can hear sounds having a frequency from 20 vibrations per second to 20 000 vibrations per second. Sounds above 20 000 vibrations per second are called *ultrasonic* sounds, and sounds lower than 20 vibrations per second are called *subsonic* sounds.

Intensity is the loudness of a sound. The intensity of a sound is measured in decibels. The decibel levels of some common sounds are: talking, 60; electric guitar, 114; jet plane on takeoff, 150; vacuum cleaner, 80; whisper, 15; and noise in an average home, 45. If a person is exposed to sound waves of 90 decibels or more for an extended period of time, permanent damage can be caused to the ears.

Sounds that produce regular and rhythmic waves are usually called music. Sounds that produce irregular sound patterns are usually called noise.

Musical instruments are designed to produce pleasant sound waves of varying pitch, intensity and quality. There are three basic kinds of musical instruments: string, wind and percussion instruments.

Chapter 4: Animal sounds, pages 119-123

Animals have developed different ways of making and receiving sounds. Some of the many fascinating sounds made by animals are as follows:

The bat is a nocturnal animal with very poor eyesight. It relies on its sense of hearing to avoid flying into things and to locate its prey. The sounds that a bat gives off are extremely powerful. It is estimated that the intensity of these sounds is equal to a four- engined jetliner about 1.5 km away. The bat does not give off sounds continuously. Instead the sounds are given off in cycles. The rate of the cycles depends on how much information the bat needs. The bat also varies the pitch of the sounds it gives off, in order to locate its prey.

One variety of moth has developed an ultrasonic sound that it emits to jam, or block, those given off by bats, as a defence mechanism.

The porpoise is able to produce both sonic and ultrasonic sounds. The ultrasonic sounds are like high clicking sounds. The origin of the sounds is puzzling as the porpoise has no vocal chords. The porpoise uses the ultrasonic sounds for navigation.

The location of ears or of hearing membranes on animals varies greatly. The katydid has an ear below each front leg joint. Some insects have hearing mem-

branes on their thorax. Mosquitoes pick up sounds with their antennae. Some butterflies and moths have hearing organs at the base of their wings. There are some fish which have two types of ears: a middle ear composed of an air bladder and an inner ear.

TEACHING STRATEGIES

The purpose of the following activities and teaching strategies is to provide you, the teacher, with a wide variety of suggestions that can be used, together with the material presented in the textbook, to help guide your students in developing the processes and concepts of this unit.

Chapter 1: How are sounds alike? pages 98-105

— Pages 97-102 can be read and discussed.
— A tape could be made of various sounds ranging from very harsh, loud sounds to soft delicate sounds. Each sound should be numbered. This tape could be placed in the science centre with the listening post. The students could *classify* each sound on a scale of one to three according to pitch. They could replay the tape and try to *identify* each sound.
— The picture on page 98 could be discussed and then a group of students could *investigate* all the sounds they hear during recess and/or noonhour. Upon presentation of information, the class could *classify* the sounds into groups (e.g. Human, Animal, Other).
— Students could create a "Clanging Kitchen" booklet to list the kinds of sounds heard in their kitchen just before dinner. Perhaps a 15 minute time limit would be sufficient. Research shows that stress levels are raised in all ages because of the overall number of sounds and their intensity (e.g. clanging pots, electric knives and can openers, whistling kettles, chinaware, chopping sounds, water running, etc.). A possible design for this booklet is offered in Activity Card 1.
— Pages 103-105 can be read and discussed.
— "Finding Out" worksheets for pages 100, 102, 103 and 105 have been included.
— "A Second Look (page 105), Worksheet 5" is available for review purposes.

Chapter 2: Hearing sounds, pages 106-110

— Pages 106-108 can be read and discussed.
— You could pose the questions:
  — "Why do you think doctors ask us not to put objects in our ears?" (Can damage the ear)
  — "What kinds of objects could damage our ears?" (Bobby pins, pencils, any pointed objects)
  — "Why is it dangerous to hit someone on the ear?" (Can break the eardrum)
— The school nurse could visit and show students how to use the otoscope. They could enjoy looking in each other's ears. Remind students to be very gentle.
— You could pose the question "Is there a purpose for the earlobe?" (mainly cosmetic i.e. jewellery). Students could be detectives to *find out* which friends and members of their family have "free" or "fixed" earlobes. See "Earlobes—Fixed or Free?, Activity Card 2".
— "One Word Only, Activity Card 3" has been designed to encourage students to think of one word (the same word) to answer each question.
— Page 109 can be read and discussed.
— Making a Puzzle: The drawing on page 108 could be enlarged using the opaque projector; the picture could have irregular sectional lines drawn over it to make a puzzle. This would be photocopied for students. They could cut it into pieces and reassemble it on art paper.
— The "Finding Out" (page 110) can be recorded on Worksheet 6.
— "A Second Look (page 110), Worksheet 7" is available for review purposes.
— You could pose the questions:
  "What is the difference between sound and noise?"
  "What is noise pollution?"
  If your community has anti-noise bylaws, the students could discuss:
  (a) some of the bylaws
  (b) why they were drawn up
  (c) how they benefit a community.
  Comical posters could be designed to prevent noise pollution in school or community. They can be displayed in the halls for others to enjoy.

Chapter 3: High and low sounds, pages 111-118

— Pages 111 and 112 could be read and discussed.
— To illustrate the link between vibration and sound place rice grains on the skin of a drum and tap the drumhead.
— "Finding Out" (page 113) could be recorded on Worksheet 8. Read "Size of Objects" (page 113).
— To add *variables* to the "Finding Out", you can assemble a Stretchy Band and Jug Group! Your students will discover that various widths, slackness and tightness of rubber bands change the sound. A short melody could be developed with these instruments. See "The Stretchy Band, Activity Card 4". A group of six could make up each band. Each group could dress up and perform for another class.
— To demonstrate that the length of the air inside a tube changes the pitch of a note, students can experience this using waxed straws. One end of a waxed (not plastic) straw should be flattened and 1 cm cut off each flattened side. Put the cut end into the mouth past the lips. Blow on one end. Keep practising. The squawk will come eventually!

  Have the children *predict* what would happen if the straw were shorter. While they are blowing on the straw, have each person cut a piece off at the opposite end. Did their *hypotheses* work?

— Pages 114 to 118 can be read and discussed.
— Any films demonstrating the making of musical instruments would reinforce the chapter's concepts.
— Invite upper intermediate band students to bring their instruments to your class. Each player could explain the principle of an instrument and demonstrate it. Later they could play for the class as a group to show how sounds blend.
— Any or all of the following activities can be done to reinforce the science concepts in this chapter. It would be fun to have a concert if *all* these instruments were made. Perhaps you would like a few adult helpers to assist students.
  (a) Children would enjoy making simple guitars to show why smaller vibrating things make higher sounds than larger vibrating things. See "Simple Guitar, Activity Card 5".
  (b) "Finding Out" (page 117): A worksheet is available. The directions can be followed from the text.
  (c) "Do Re Mi, Activity Card 6" has been designed to show how sounds change in pitch in relation to the length of the straw. Students could learn the song "Do-Re-Mi" from the musical *Sound of Music*. Each time mention is made of one of the sounds, a pupil could blow on that straw. Have fun!
  (d) Students might want to construct and experiment with a xylophone. Activity Card 7 describes one way to construct a xylophone.
— "A Second Look (page 118), Worksheet 10" is ready for review purposes.

Chapter 4: Animal Sounds, pages 119-123

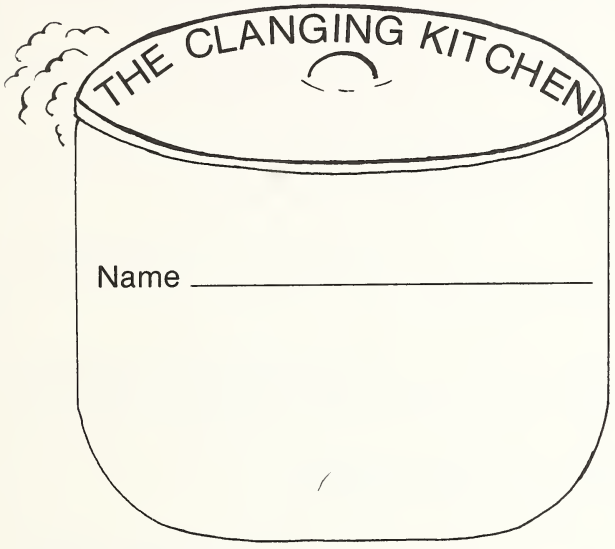
— Pages 119-120 can be read and discussed.
— Insects could be collected by students in large jars, for the purpose of listening to their sounds (e.g. grasshopper, fly, cricket, flying mantis, bee, moth, etc.). Their sounds could also be *classified* as high to low in pitch and as loudest to softest.
— Groups of students could *research* the different ways an animal or an insect makes sounds. Their information can be recorded on Flip-It Cards. See the example on Activity Card 8.
— Pages 121-123 can be read and discussed.
— Models of animals' and humans' ears could be made of plasticene or clay. Pupils could gather information, record it and place the model beside it. See the example "Animal and Human Ears, Activity Card 8". You might also wish them to compare their animal's ear with the human ear.
— Drama—"What Am I?, Activity Cards 9-1 to 9-25" have been prepared for each member to portray the sound of an animal, bird or insect. These cards can be cut out and pasted onto bright coloured cardboard. They can be put into a box covered with animal patterned paper and the students could each pull a card. Each person acts out the sound in front of the class and he or she asks volunteers to make suggestions. The person could make the sounds behind a screen or chart rack. In this way, no one's actions could be seen.
— "Getting Attention, Activity Card 10" allows students to think about sounds used by animals and develops an awareness of the different ways that animals seek attention through sound. (Answers: (1) howl (2) slaps (3) beats (4) whinny (5) squeal (6) rattle (7) growl (8) whistle (9) purr (10) spit (11) bellow)
— "I Wonder, Activity Card 11" has been included to encourage *critical thinking skills*. The questions could be cut out and pasted onto cards with an appropriate picture. They could be displayed as a mobile and students could choose one or two to answer. Some may require research. (Answers: (1) It has folds of heavy skin to keep water out of its ears. (2) Its ears are hidden under its feathers. (3) Answers will vary. (4) It belongs to one person only. (5) A German Shepherd (6) Most dogs with erect ears such as a German Shepherd or Doberman.)
— "A Second Look (page 123), Worksheet 11" is available for review purposes.

WORKERS WHO USE SCIENCE

— A speech therapist could visit the classroom to discuss the profession and give examples of cases.
— A hearing specialist or therapist could visit. Perhaps they may have records to show how a hearing-disabled person hears a conversation.
— Hearing-disabled persons could visit the classroom to explain how they have overcome their difficulties.
— The school health nurse could explain
  (1) the ways to detect a person with a hearing problem
  (2) the kinds of testing equipment used
  (3) how students can help a deaf person.
— The local veterinarian could be invited to show the students how he/she examines a dog or cat's ear using an otoscope. Perhaps they would like to prepare a list of questions to ask the veterinarian about the care of their pet's ears.

CLANGING KITCHEN

design



Make 2 copies

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Copy 2: omit name and insert lines e.g.

Sounds Around You, Activity Card 1

FINDING OUT (Page 100)

What do you hear?

What is happening to the ruler while it is making a sound?

Sounds Around You, Worksheet 1

FINDING OUT (Page 102)

What do you see?

What do you hear?

What do you think is making the sound?

Why?

How do you think your vocal cords and the sides of the balloon are alike?

Sounds Around You, Worksheet 2

FINDING OUT (Page 103)

Could you hear the sound of the spoon from any place in the circle?

Did you hear the sound of the spoon?

Did you hear the sound of the spoon the third time?

In what directions can sound travel?

Sounds Around You, Worksheet 3

FINDING OUT (Page 105)

Did your telephone work?

If so, how did your voice reach your partner's ear?

Sounds Around You, Worksheet 4

A SECOND LOOK (Page 105)

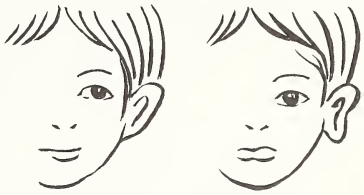
In what ways are sounds alike?

How are sounds made?

In what ways do sounds travel?

Sounds Around You, Worksheet 5

Earlobes



My earlobes are _____.

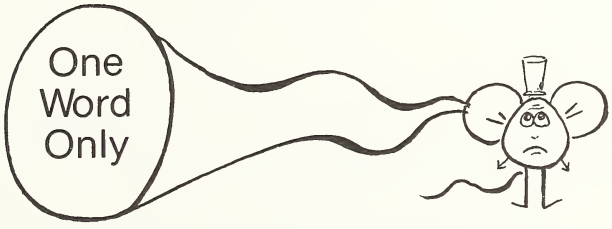
My family (Name)			

Which type is the most common in your family? _____

My friends (Name)			

Which type is the most common among your friends? _____

Sounds Around You, Activity Card 2



You can answer each sentence below with one word—and—each sentence has the same word for the answer. Think carefully!

1. Each year we spend millions of dollars to fill our rooms with something you never see. What is it?_____
2. If you are in one room—how do you know if someone is in another room?_____
3. You are in a room with no windows. You know a fire engine is racing past your house. How do you know?_____
4. Something you didn't see saved your life yesterday when you went to cross the street. What was it?_____

Sounds Around You, Activity Card 3

FINDING OUT (Page 110)

How many times did you guess right?

How many times did you guess right the second time?

Which way did you find it easier to tell where the sounds were coming from?

Sounds Around You, Worksheet 6

A SECOND LOOK (Page 110)

What things does the outer ear do to help you hear sounds?

In what ways does hearing sounds with both ears help you?

Sounds Around You, Worksheet 7

FINDING OUT (Page 113)

Did tightening the rubber band make the sound higher?

If so, why?

Sounds Around You, Worksheet 8

The Stretchy Band

All groups will need: Rubber bands—4 mm wide and about 10 cm long, plus other widths of the same length
Empty jars (e.g. coffee jars)
Pottery mugs (not plastic or paper coffee cups)
Empty boxes, tins.

Group one: Put one 4 mm wide and 10 cm wide rubber band on your object. Pluck it to obtain the sound.

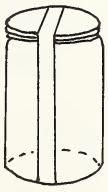
Group two: Put two or three bands of the same length but different widths around your sound box. Stretch each band the same amount. Pluck them to get to know the sounds.

Group three: Put two or three bands of the same length, but different widths, around your second box. Slacken one and tighten the other two. Listen to the pitch of each. Try to make up a tune.

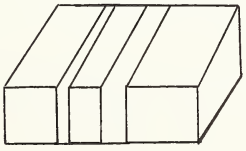
Group four: Stretch a wide elastic band from top to bottom of a wide-mouthed jar. Put a pen under the rubber band across the top of the jar.

Pluck the band on each side of the pencil. Listen to the sound. Now try to move the pencil steadily across the top of the jar *and* at the same time pluck the band. Interesting, isn't it?

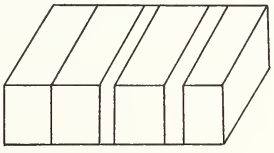
If you pull the band a little tighter over the top of the jar, you will have a higher note. If you loosen it, you will get a lower note.



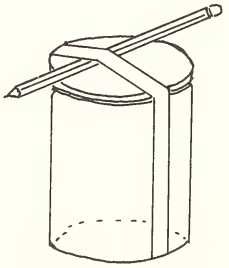
Group 1



Group 2



Group 3



Group 4

Sounds Around You, Activity Card 4

SIMPLE GUITAR

You will need: A cigar box or similar small wooden box
Piece of dowel about 10 cm long
String or heavy chord 1 m long
Small saw and hand drill
Piece of wood 35 cm long × 8 cm wide
Small wedge of wood (see picture)
Screw, saw

— Cut a hole in the top side of your box with the saw. An adult can show you how.

— Drill a hole through the piece of wood the width of your dowel.

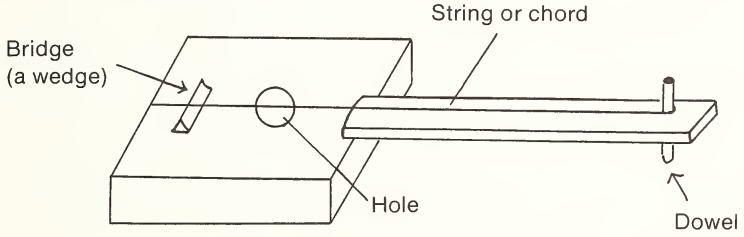
— Screw the piece of wood to the cigar box to make the arm of the guitar.

— Put a screw in the box in the end opposite to the arm.

— Tie chord to the screw and stretch the chord to the dowel. Wrap chord around the dowel. Tie.

— Place a wedge of wood under the chord as in the picture.

You are ready to play your instrument!! Enjoy yourself!



Sounds Around You, Activity Card 5

FINDING OUT (Page 117)

What do you think is vibrating in the bottles to make sound?

Why do you think all the bottles make about the same sound?

Which bottle made the higher sound?

Why?

If you wanted to make some of the sounds higher, what might you do?

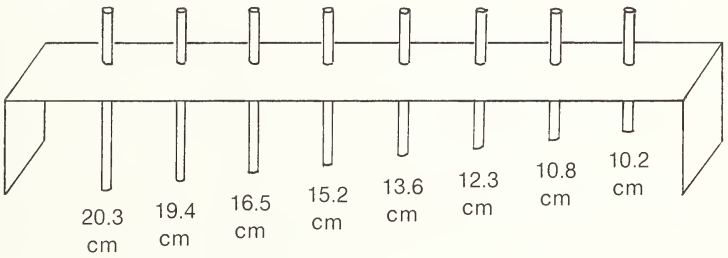
If you wanted to make some of the sounds lower, what might you do?

Sounds Around You, Worksheet 9

You will need: —Straws at least 21 cm long OR
a length of plastic, cardboard or copper tubing about 120 cm long
—a hack saw or knife depending on the type of tubing used
—cardboard holder (see picture)

— Measure the straws or tubing carefully using the lengths shown in the picture.
— Have an adult check your measurements.
— Cut the tubing very carefully.
— Cut 8 holes, equal distances apart and in a straight line into the cardboard holder (See picture). These holes must be the width of the tubing.
— Insert the tubing into the cardboard holder so that each tube is the same distance from the top of the box.
— Blow across them in order of length. Presto! A major diatonic scale has been made.

Try to compose a short tune using these eight notes.



Sounds Around You, Activity Card 6

A SECOND LOOK (Page 118)

How might making something vibrate faster change the sound it makes?

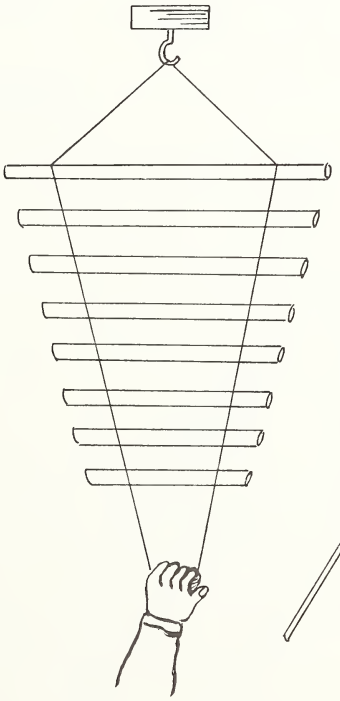
What might make some things vibrate faster than other things?

Sounds Around You, Worksheet 10

You will need: File
Ball of heavy string
a ruler
a pencil
a hacksaw
Piece of copper tubing 130 cm long × 13 mm wide
(Note: 2.5 cm × 1.2 cm wood may be used instead of copper tubing)

— Saw the tubing into the lengths shown in the picture. Have an adult check your measurements before you cut the tubing.
— Loop the string around the tubing a short distance from each end.
— Try striking the tubes in the middle, one after another. Do they produce a musical scale? If not, try "tuning" the copper tubes. To lower the pitch file the middle of it a little at a time. Test it again. To raise the pitch of the wood, file the ends of the tube.
— When you get it in pitch, you are ready to play a musical scale. Try it!

Try to make a little tune using these eight notes.

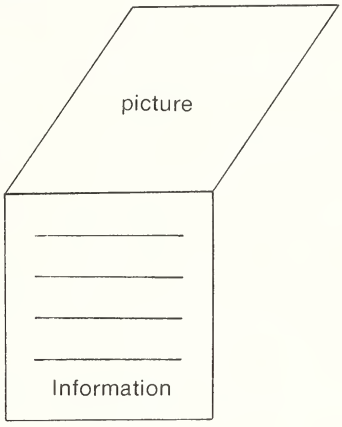


Low Do	20.3 cm
Re	19.4 cm
Mi	16.5 cm
Fa	15.2 cm
So	13.6 cm
La	12.3 cm
Ti	10.8 cm
Do	10.2 cm

wooden hammer

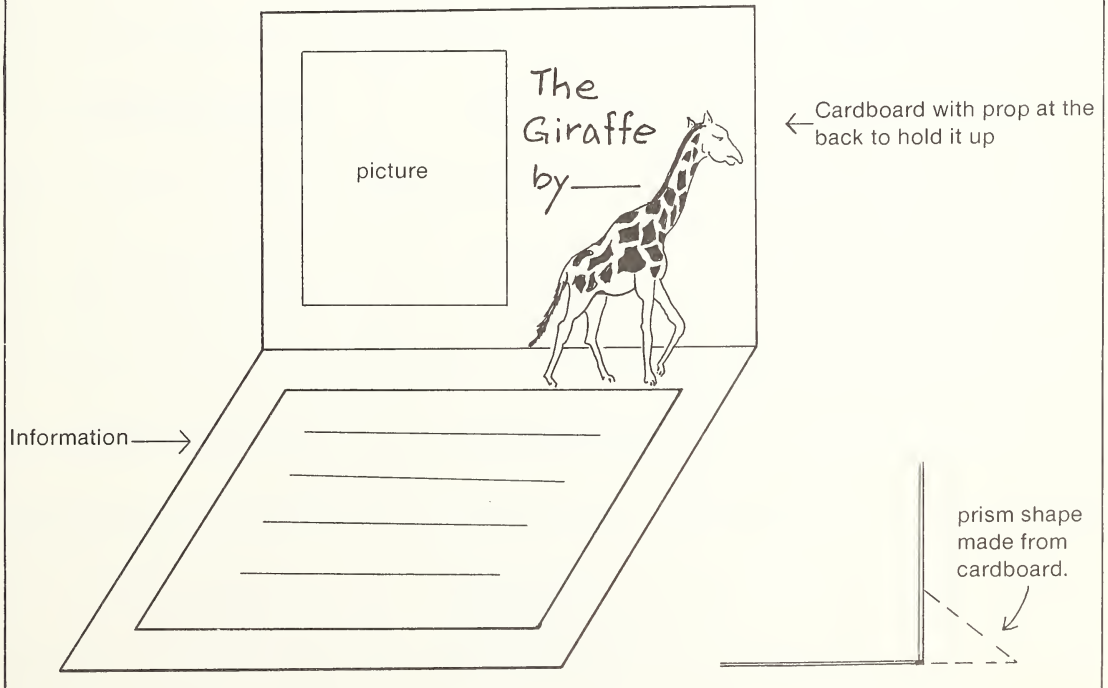
A Xylophone

Design for **FLIP-IT** Cards



Design for

Human and Animal Ears



Sounds Around You, Activity Card 8

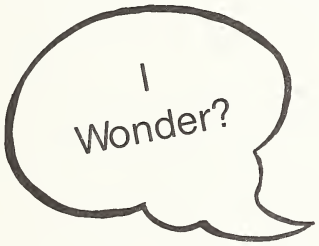
A lion roars	A tiger roars	Seals bark
Cows bawl	Sheep bleat	Wolves howl
Coyotes howl	Grizzlies growl and grunt	Bees buzz
Flies buzz	Crickets chirp	Dogs growl
Rattlesnakes rattle	Mosquitoes buzz	Horses whinny
A mouse squeaks	Pigs squeal	A hen cackles
A robin chirps	Cats purr	Chipmunks chatter
Alligators bellow	Blackbirds caw	Dogs bark
Hens cluck	Drama: What Am I?	

Getting Attention

1. Wolves ___howl___ to call other wolves to join them.
2. Beavers _____ water with tail.
3. Grouse _____ the air with their wings.
4. Horses _____ to call their colts to come.
5. Pigs _____ when they see the farmer bringing food.
6. Rattlesnakes _____ to warn us to stay away.
7. Dogs _____ to show that they are unfriendly.
8. Trains _____ to warn us to stay off the track.
9. Kittens _____ when they are happy.
10. Cats _____ when frightened or annoyed.
11. Alligators _____ to attract their mates.

Sounds Around You, Activity Card 10

1. How does an alligator keep water out of its ears?
2. A robin's ears are hidden. Where are they?
3. A cricket is sometimes called an insect musician. Why?
4. How is a human voice like a finger print?
5. Which dog would hear better—a German Shepherd or a Cocker Spaniel? Why?
6. Some dogs are raised for a special reason. Dogs with erect ears often hear better. An example is a guard dog. Can you name two different dogs used for this reason?



Sounds Around You, Activity Card 11

A SECOND LOOK (Page 123)

In what ways do animals make sounds?

What helps some animals hear sounds better than you can?

What are some animals that do not have outer ears?

Sounds Around You, Worksheet 11

BLUE BOOK (3)
Unit 5: Water in Your Environment

Pages 128-159

UNIT OVERVIEW

Concept Development

In the preceding levels of the program, the following concepts were introduced and developed:
Water is found on the surface of the earth, in the air and in the soil. Moving water and ice are able to erode and weather the earth's surface. Plants and animals need water to live and grow.

The following concepts are developed in this unit. Water is one of our most precious natural resources. Living things are ultimately dependent on the nonliving resources of the earth. For example, without water, soil and air, living things would not be able to survive. Living things and nonliving things in the environment are all interrelated, and so when water becomes polluted or misused, it cannot serve its functions as effectively in the cycle of nature. Clean water, together with the other resources of air, soil and space, are not limitless or boundless. We all have a responsibility to conserve and to make wise use of these resources.

Unit 5, "Water in Your Environment," consists of four chapters. Chapter one discusses the importance of water as a natural resource. The water cycle and sources of water are explored in the second chapter. Chapter three discusses the need for clean water and some ways in which water can be purified. Some thoughts on water conservation and ways in which water can be used wisely are presented in chapter four.

Process Development

The investigations in this unit involve using objects and situations to produce interactions and changes. These types of investigations involve *observing* the characteristics of the situation before the change or the interaction. Then students will be *observing* or *measuring* the change that takes place during the interaction and noting the duration, or length of time, of the changing process. Also students will be *comparing* ways in which the objects and situations have changed. Finally, from the observations or comparisons, students will be *inferring* possible reasons for changes or trends. There are also opportunities in the unit to help students develop scientific and personal *attitudes* toward environmental concerns.

Students first *investigate* the importance of saliva in the digestive process by *comparing* how bread tastes with and without saliva. From their observations and comparisons, they *infer* that saliva helped break down and change the bread as part of the digestive process (page 132).

In the "Finding Out" on page 139, students *compare* the effect of salt water and fresh water on the growth of plants, by *observing* plant growth over the period of a few days.

Evaporation and its causes are then *investigated* on page 144. Students use the information gained through their observations to *infer* why water vapour formed on the pan and how warm water changes into water vapour. From their inferences, students then *hypothesize* on how water evaporates from the earth's surface.

The way in which a filter helps purify water is *investigated* on page 148. Students construct a water filter and they *observe* and *compare* how the filter helps purify muddy water.

The unit ends with students *investigating* a method of obtaining fresh water from salt water (page 155).

Related Units

Living Things *Orange Book (1)*
Environment *Gold Book (2)*
Rocks and Soil *Gold Book (2)*
Seed Plants *Blue Book (3)*
Solids, Liquids, and Gases *Brown Book (4)*
Air and Weather *Brown Book (4)*
The Changing Land *Green Book (5)*
Ecosystem Earth *Red Book (6)*
Earth: Its Nature and Importance to You *Exploring Earth and Space (7)*
Water: More Than a Resource *Exploring Earth and Space (7)*

Materials and Advance Planning

The following list includes the materials that a student, or in some cases a group of students, need to carry out the activities in this unit. In some instances, other materials may be substituted for those on the list.

Piece of bread, 2 plants, salt, hot plate or another source of heat, 2 cooking pans with handles, tray of ice cubes, glove or oven mitt, empty milk carton (2 L), small plastic or glass container, 3 pieces of charcoal or some aquarium charcoal, clean sand, cotton wool, drinking

glass, clear plastic kitchen wrap, rubber band, black paper, small hand shovel, some fruit juices, 2 salt water plants

Plant some bean seeds in preparation for the "Finding Out" on page 139. If you plan to do the extension activity on the same page, locate a source for the 2 salt water plants.

BACKGROUND INFORMATION

Chapter 1: Why is water important?, pages 130-137

The concept that water is essential to the survival of living things is an important one. People need water every day for the body to carry out its functions. It is estimated that a person takes in about 60 000 L of water in a lifetime. Water serves a number of functions in the body. Water makes up about eighty percent of a person's total volume of blood. Body fluids, such as perspiration, saliva and digestive juices are also made up mostly of water. During metabolism (the process whereby body cells use nutrients and oxygen to produce energy for the body) certain waste products need to be eliminated from the body. Water plays an important function in excretion.

Water has many uses in the home and in industry. It is estimated that an average person in Canada uses about 90 000 L of water each year for bathing, for cooking, for washing and for flushing away wastes. Printing one copy of a newspaper requires the use of about 250 L of water. About 1300 L of water is needed to make 1 kg of aluminum. Hydroelectric power is an important source of electrical energy. Water also serves many recreational purposes.

Chapter 2: Where does water come from?, pages 138-144

In this chapter, you may wish to stress the following three concepts. Water exists in three phases: as a solid (ice), as a liquid (fresh and salt water) and as a gas (water vapour). The second concept is that water is a reuseable resource. Finally, there is the concept that the water cycle is one of the earth's great recycling systems.

The earth's water is stored as surface water, as soil moisture, as ground water and as water vapour in the atmosphere.

If your students were to look at a globe of the earth, they would probably be impressed by the abundance of water. Almost three-fourths of the earth's surface is covered by water. Of the water on the surface of the earth, about three percent is fresh water and is found in lakes, in rivers and in icecaps. The remaining 97% is found in the oceans as salt water.

People's requirements for fresh water are obtained from ground water, rivers and lakes. Sources of ground water develop when surface water soaks into the soil and porous rocks until it reaches a layer of solid impermeable rock, through which the water cannot pass. The water saturates the porous rock and soil above this impermeable layer. The upper level of this ground water is called the water table. The water table will fluctuate in depth below the earth's surface depending on the amount of water that soaks into the ground. When the land surface dips below the water table, then a spring or lake may form there.

Fresh water is continually being replenished in a great recycling system, called the water cycle. The water cycle begins with water from the land and the oceans evaporating and rising into the air as water vapour. As it rises, the water vapour is cooled and condenses to form clouds. When there is sufficient moisture present in the clouds, precipitation occurs, and fresh water is returned to the earth's surface. Throughout the water cycle, there is some change taking place in the quality of the water. As water evaporates from the ocean, most of the salts and minerals are left behind. As water seeps into the earth it dissolves minerals and picks up organic materials.

Chapter 3: How is water made safe for people to drink?, pages 145-149

This chapter deals with an applied science—the science of purifying water so that it can be used by people.

Sources of water for a city's water supply are usually contaminated by soil sediment, waste materials, or by bacteria. The water usually has to be purified in a water treatment plant before it is safe to use. The water-treatment plant described in this chapter uses the following process in water purification.

When the water enters the water-treatment plant, it is run into a large basin where the largest sediment settles. The water is then run into a large settling tank where chemicals, such as alum and lime, are added. The chemicals change into a gelatinous, sticky substance that traps bacteria and fine particles causing them to sink to the bottom of the tank. The water is then run into a filtering tank that contains layers of sand and gravel. It removes more bacteria and fine sediment. Charcoal may be added to the filter bed to remove any gases that might give the water a bad taste. The filtered water is then pumped into a storage tank where chlorine may be added to kill any remaining bacteria.

Then the water may be stored in reservoirs or water towers. From there, it moves by gravity or is pumped into underground pipes linked to homes and other buildings.

Chapter 4: How can water be used wisely?, pages 150-155

You may wish to develop an understanding of the concept "pollution"—a state of being impure and unsuitable for use. Another concept that you may wish to stress is that when water becomes misused or polluted,

it cannot serve its functions effectively in the cycle of nature. There are many things that people can do to conserve water and make wise use of it. This is a responsibility that we all have to share.

Water conservation can begin at home where water can be used wisely. Water can also be conserved by reducing the amount of surface run-off. Planting forests on bare slopes and collecting run-off water behind dams are two ways in which this can be done. Another important way to conserve water is to control water pollution and to recycle waste water by purifying it. Many cities and factories adequately treat their sewage before it is returned to rivers, lakes, or the ocean. However, there are some cities and industries that do not. Thus pollution of water supplies continues.

People are continually looking for new sources of fresh water for future needs. One source that is being studied more and more is retrieving fresh water from the ocean. This requires the removal of salt from the ocean water. One way of obtaining fresh water is by freezing ocean water. The ice that forms is composed largely of fresh water. The ice can then be removed and melted, yielding fresh water. Another source that is being considered is the use of icebergs. When ocean water freezes, the salt separates from the ice crystals that form, resulting in fresh water.

A more common method of obtaining fresh water from the oceans is to distill salt water. The ocean water is evaporated, leaving the salt behind. The water vapour is collected and condensed into fresh water. Desalination plants have been built in a number of coastal areas in the world, but this is still an expensive way to obtain fresh water.

TEACHING STRATEGIES

The purpose of the foilowing activities and teaching strategies is to provide you, the teacher, with a wide variety of suggestions that can be used, together with the material presented in the textbook, to help guide your students in developing the processes and concepts of this unit.

Chapter 1: Why is water important?, pages 130-137

— The information on pages 129-132 can be read and discussed.
— Students could discuss the meanings of the words: environment, sweat and saliva.
— The class could make a large mural to show how water is used. A film, videotape, or filmstrip related to water uses could be used as a motivator for the mural. A series of main ideas from the film could be listed on the blackboard and students would choose their own category to study. Working individually or in small groups, students could arrange their information and pictures on large pieces of art paper. These sheets could be joined together into a cumulative project.
— The students would enjoy doing the *experiment* listed in the teacher's guide (page 131). This could be performed on the school lawn.
— To extend the concept that plants need water, a walking field trip could be made to a nearby forest or to the school grounds to *observe* the results of water in these environments. On this field trip, students could be observing trees and soil, collecting soil samples and examining their *data*. "A Walk Through the Forest, Activity Card 1" and "Amazing Soil, Activity Card 2" are offered in this guide.
— The children could try the "Finding Out" activity on page 132 and "Extending the Finding Out" on the same page. Worksheets 1 and 2 are provided for students to record their information. To understand the word "saliva", you could have the children imagine that they are sucking on a lemon. It could be referred to as being very sour! You could then ask: "What is happening in your mouth right now as you think about this very sour lemon?". "How Can You Tell..., Activity Card 3" is available to record findings.
— Information on pages 133-136 can be read and discussed.
— Students could be asked to do a project at home to *record* all the ways that their family uses water within the home in one day. The front, back and inside pages of the report could be in the shape of a house. A sample "Uses of Water in..., Activity Card 4" has been supplied. This pattern can be mimeographed on construction paper and white paper. Students could cut out the pattern and have the pages stapled together.
— The children could be divided into groups and a different collage could be created by each group. Possible themes include: Water as Transportation, Water as Recreation, Water Uses in Winter, Water Used in My Home, Water Added to Foods.
— "A Second Look, Worksheet 3" is available for review purposes.
— It would be fun to have a taste-testing party. You could use the dehydrated foods available for campers. This would involve measuring and adding water to each type of food.
— If it is winter time when this unit is being studied, the children could make "Snow Ice". The recipe is included on Activity Card 5.
— A field trip around the community could be made to *observe* and take pictures of the community's uses of electricity. Pictures could be taken of:
hydro towers, telephone and power lines, dams, generators, building lights, air conditioners, sirens on buildings, billboard lights, emergency lighting, stoplights, neonlights, decorative garden lights, etc.

Chapter 2: Where does water come from? pages 138-144

— The information on pages 138-139 can be read and

discussed.

— The "Finding Out" and "Extending the Finding Out" on page 139 could be done by different groups. Worksheets 4 and 5 are supplied for recording results.

— "Water, Water Everywhere!, Activity Card 6" is offered as a language activity and to develop *critical thinking skills*.

— The section "Fresh Water", (page 140) can be read. You could ask the students if they have a well at home or at their summer place. If so, how deep is it? Is it a "dug" well or an artesian well? If water is supplied in your community by municipal pipelines, enquire: "Where do you think our water supply originates? Where is it stored? Is it metered? If so, how much does it cost?"

— The children would enjoy having a person come to the school to demonstrate the use of a divining rod.

— Pages 141 and 143 could be read. Students could make a rain-measurement instrument of their own design. If it is rainy weather when this unit is being studied, students could *collect*, *measure* and *graph* the amount of rainfall for each day using the instruments that they have designed.

— Children could be taken outside to lie on the school lawn and to watch the clouds. Their *observations* about the clouds' shapes, appearances and movements would assist them to write poems about clouds. They could draw a cloud shape on white paper, outline the edge with a blue felt pen and print their poem on this shape. A large mural could be made showing the skyline of their community and the cloud poems could be placed above the skyline.

— A set of What if .... cards could be made for the students to use in partner groupings. These cards could be in the shape of clouds or large question marks. Samples of questions might be:

(a) What if all water tasted like strawberry juice? Think of several ways this would change our water.

(b) What if the oceans dried up? How would this change life?

(c) What if the lava from Mount St. Helens covered up all the streams and lakes? How could animals get drinking water?

(d) What if an oil slick was on a pond? How could birds be harmed?

(e) What if there were no more factories? How could this change the water and our lives?

— Worksheet 6 for "Finding Out" and Worksheet 7 for "A Second Look" (page 144) are included in this unit.

Chapter 3: How is water made safe for people to drink?, pages 145-149

— The information on pages 145-149 can be read and studied.

— Worksheet 8 for "Finding Out" (page 148) and Worksheet 9 for "A Second Look" (page 149) are offered.

— You might wish to take the children on a field trip to a local water-treatment plant.

Chapter 4: How can water be used wisely? pages 150-155

— Information on pages 150-153 can be read.

— Students could *brainstorm* items that make the water in rivers, streams and lakes unclean. These could be listed on a chart.

— Pairs of students could make 'before and after' pictures using the design on Activity Card 7. These posters could be displayed in local stores to attract community awareness to pollution.

— A "Turn Off Pollution" project could be developed by the class. The students could take pictures of polluted areas along riverbanks, streams and ponds in the community. A clean-up campaign could be conducted by students. Often local newspapers are willing to give publicity to such community and school efforts.

— An anti-pollution campaign could be kicked off by all students in the school. This campaign could relate to all types of pollution — water, air and noise. The main thrust of the campaign could be held on a Saturday morning on a main street or in a shopping centre. There would be a parade of students led by students carrying a huge banner saying 'Tidy Bugs on the March!'

Students could make posters on bristol board or manilla tag saying "Tidy Bugs Lurk Here!". These signs could be laminated and attached to buildings or posts near refuse containers.

Students could design their own T-shirts "I'm a Tidy Bug". Printing can be done with felt pen or fabric crayons.

Anti-pollution booths could be set up on the streets. These booths could have "before and after" pictures and information about air, water and noise pollution. Students could have a button slogan contest: e.g. "I joined the Tidy Bugs". These can be sold at the booths for a nominal sum. A ribbon could be given to each entrant and prizes given to three finalists.

Campaign songs can be made up by each class to a familiar tune. These songs can be sung as they parade along the street. Perhaps the school band could lead the group.

— Worksheet 10 is provided for the "Finding Out" (page 155) and Worksheet 11 is available for "A Second Look" (page 155).

— Student and/or puppet plays could be made up with themes relating to the topic of water pollution. Possible themes:

— Why Me?!! An 'I don't care' person confronts a group of kids who challenge this attitude.

— Fish Speak Up! — a personification of a fish's reaction to water pollution.

A Walk Through the Forest

Choose two trees beside each other on the edge of the forest.
Put a tick mark (✓) on the chart below to show what you found.

TREES AT EDGE OF FOREST	Wet on left side of tree	Wet on right side of tree	Wet all around tree
Tree #1			
Tree #2			

Are they the same or different?

Why do you think this is so?

Now walk into the forest.

Look at two trees. Mark the chart below.

TREES IN FOREST	Wet on left side of tree	Wet on right side of tree	Wet all around tree
Tree #1			
Tree #2			

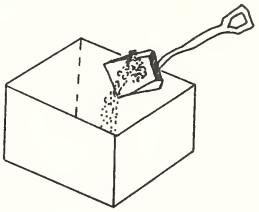
Are they the same or different?

Which trees were more wet—the ones at the edge of the forest OR in the forest?

Why?

Water in Your Environment, Activity Card 1

Amazing Soil



You will need: a two-litre milk carton
a small trowel or shovel
Walk into the forest where there are lots of trees and damp soil.
Fill your carton with soil.
Take it back to your classroom.

Weigh your carton of soil. Mark its weight on your chart under Day 1.

SOIL	Day 1	Day 2	Day 3	Day 4	Day 5
Weight					

Weigh it each day for five days. Mark down its weight each day on the above chart.

Look at the weight of the soil on the first and fifth day.
Does it weigh more or less on the fifth day?

Why do you think this is so?

Water in Your Environment, Activity Card 2

FINDING OUT (Page 132)

What does the bread taste like when you put it on your tongue?

What does the bread taste like when you mix it with saliva?

What caused the change?

Water in Your Environment, Worksheet 1

EXTENDING the FINDING OUT (Page 132)

Discover some other foods which saliva helps to change.

Place one kind of food on your tongue. Do not chew it. What does it taste like? Record your findings on the chart below.

Now mix the same food with saliva. Do not chew it. What does it taste like now? Record your findings.

Do the same with each kind of food.

Kind of Food	Without saliva	With saliva

Water in Your Environment, Worksheet 2

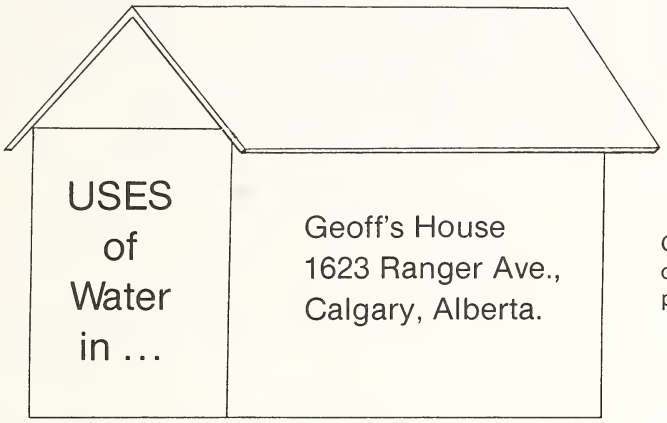
How can you tell?

What is happening in your mouth right now?

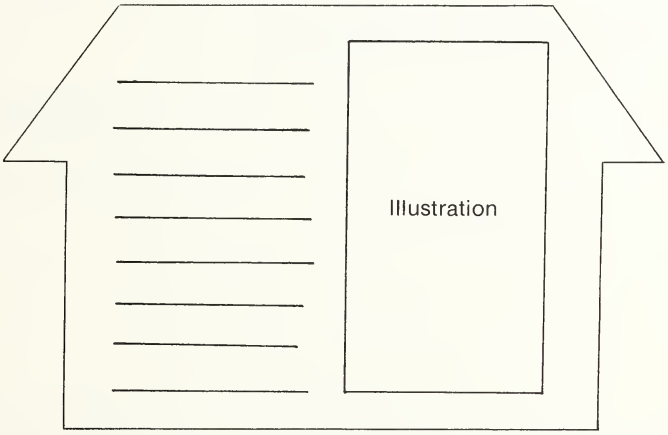
You are thinking about a very sour lemon! Pretend that you are sucking it. What is happening in your mouth now?

Water in Your Environment, Activity Card 3

These drawings could be on a larger scale for students.



Outside covers could be run off on photocopier. (Construction paper would be best.)



Inside pages could also be photocopied sheets that the students cut out and assemble before the project begins.

Water in Your Environment, Activity Card 4.

A SECOND LK (Page 137)

In what ways does your body use water?

What are some other ways people use water?

What are some things water is used to make?

Water in Your Environment, Worksheet 3

SNOW ICE

You will need: a tall glass
fresh, clean snow
juice (grape, orange, strawberry, or raspberry)
spoon (optional)

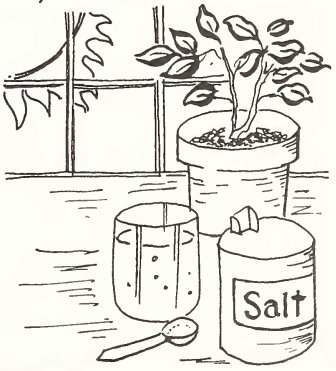
Fill your glass with *clean* snow.
Add fruit juice.
Enjoy! ! !

Water in Your Environment, Activity Card 5

FINDING OUT (Page 139)

Was the salt water harmful to the plant?

If so, how could you tell?



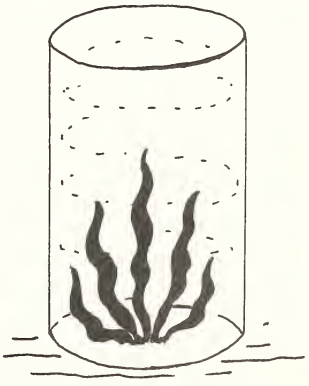
Water in Your Environment, Worksheet 4

EXTENDING the FINDING OUT

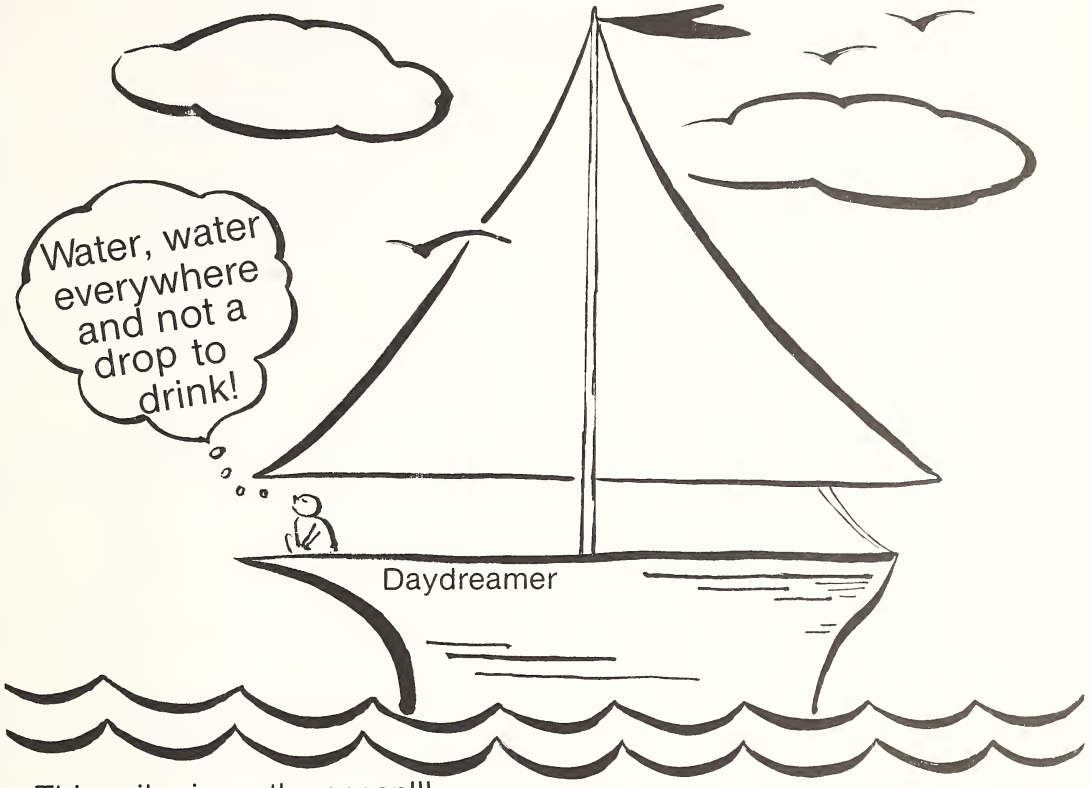
You have been growing ocean plants in fresh water.

Is fresh water harmful to ocean plants?

If so, how could you tell?



Water in Your Environment, Worksheet 5



This sailor is on the ocean!!!
What does he mean?

Water in Your Environment, Activity Card 6

FINDING OUT (Page 144)

What did the heat do to the water in the pan on the hot plate?

Where did the drops of water on the bottom of the pan with ice come from?

What do you think heats water on earth so that it evaporates?

Water in Your Environment, Worksheet 6

A SECOND LOOK (Page 144)

How is ocean water different from fresh water?

Where can fresh water be found?

How does water get into the air?

Water in Your Environment, Worksheet 7

FINDING OUT (Page 148)

In what way does the filtered water look different from the muddy water?

In what way does a filter help clean muddy water?

Water in Your Environment, Worksheet 8

A SECOND LOOK (Page 149)

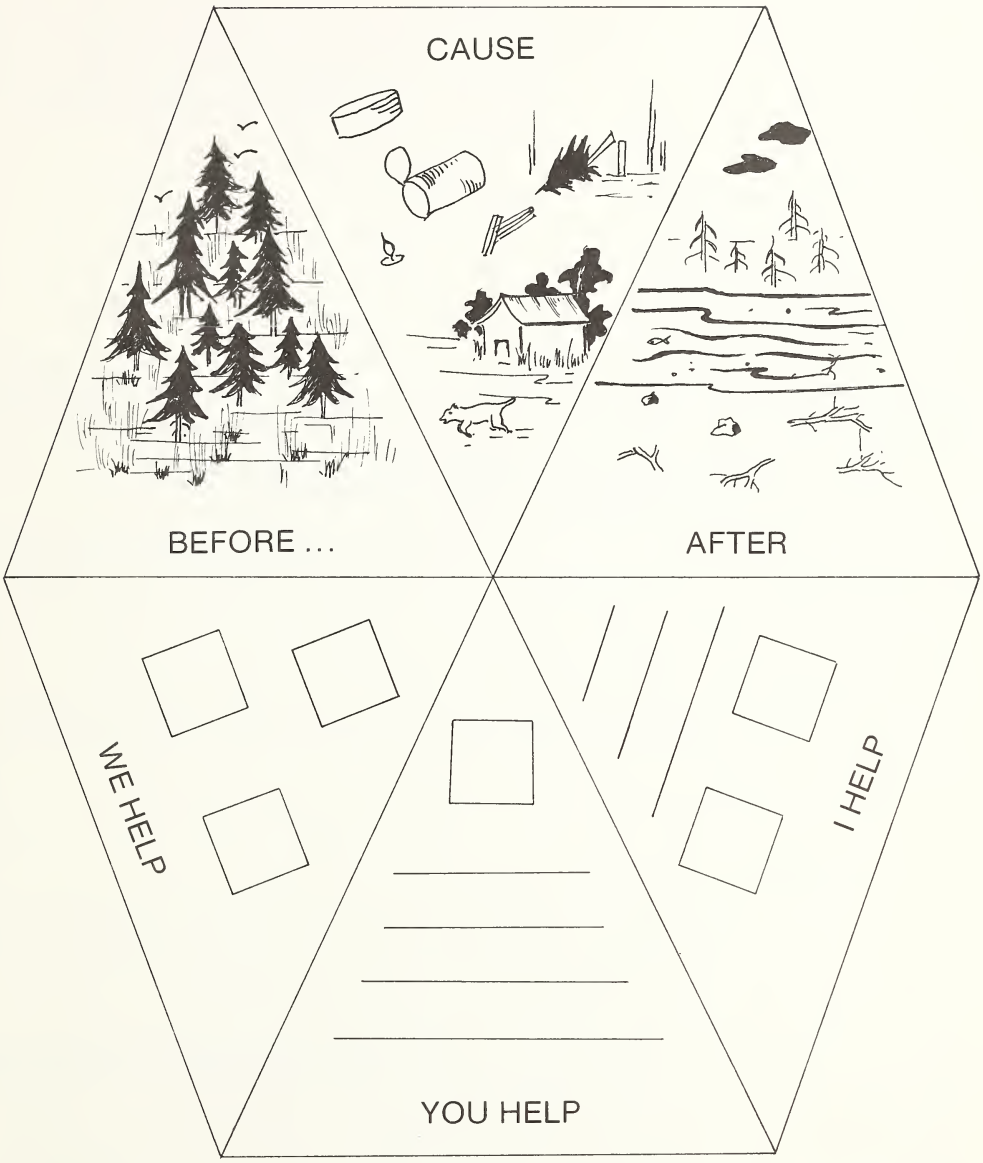
What things may make lake and river water unclean?

What does a water-treatment plant do?

How does clean water get to homes and other places?

Water in Your Environment, Worksheet 9

"BEFORE and AFTER" design example



FINDING OUT (Page 155)

Which water was fresh water?

Do you think the sun helped change the salt water into fresh water? If so, how?

Water in Your Environment, Worksheet 10

A SECOND LOOK (Page 155)

Why is it important for people to use water wisely?

What are some cities and factories doing to help control water pollution?

Why is being able to change salt water into fresh water important?

Water in Your Environment, Worksheet 11

BLUE BOOK (3)
Unit 6: Location, Motion and Force

Pages 160-185

UNIT OVERVIEW

Concept Development

In the preceding levels of the program, the following concepts were introduced and developed:

The spatial relationship of an object involves describing it with respect to some given properties. Some words that can be used to describe position and movement are: front, back, left, right, higher, lower, near, far, fast and slow.

Unit 6, "Location, Motion and Force", is comprised of three chapters. In these chapters students learn more about space-time relationships. Being aware of, and having the vocabulary to describe space-time relationships of objects in the physical environment is necessary to many aspects of everyday living.

Chapter one defines the concept of "location", and explains how reference objects are helpful in determining the location of people and places. Chapter two introduces the concept of "motion" and some properties of moving objects. Also included in this chapter is a discussion of the way that tracks can provide clues to the manner in which an object moved. The third chapter defines the concept of "force" and develops the understanding that a force is always needed to produce motion, to stop motion, or to change the direction of the motion of an object.

Process Development

In *observing* and *describing* space-time relationships in this unit, students use *quantitative* and *qualitative* forms of *measurement*. Students can describe an object in terms of its qualities, such as position, location and movement. These observations, however, become more significant and useful when they are expressed in quantitative terms, by applying a standard of measure to them. For example, consider these three observations, based on the "Finding Out" on page 177:

The rock is heavy. (qualitative)
The rock weighs 1 kg. (quantitative)
The rock is heavier than the shoe. (qualitative)

The first statement is open to interpretation, because the observer's concept of "heavy" is not known. The second statement is more precise, and can be understood by other people, because a standard unit of measure has been used. The third statement, although it is not as precise, can be understood by people who have some experience with how heavy a shoe is. The preciseness of your students' observations will depend largely on their experience with using measurement. As teachers, we should give students many opportunities to develop *measurement skills*.

In the "Finding Out" activities students first describe the spatial relationships of places in their neighbourhood. Then they *classify* these places in terms of importance, use and distance. Students will then *interpret data* shown on their map (page 165). They *experiment* with *variables* that cause a yo-yo to move up and down (page 171). This is followed on page 177 by an *investigation* of the force of gravity on different things. Students *predict* and then *measure* the force of gravity. Finally, the students *experiment* with some forces that can be produced to move marbles, by blowing and then rolling the marbles (page 181).

Related Units

Spaces and Places *Orange Book (1)*
Work and Machines *Brown Book (4)*
Energy For Work and Motion *Exploring Matter and Energy (7)*
Technology: Using Science *Exploring Matter and Energy (7)*

Materials and Advance Planning

The following list includes the materials that a student, or in some cases a group of students, will need to carry out the activities in this unit. In some instances, other materials may be substituted for those on the list.

Yo-yo, bathroom or spring scale, 3 or 4 heavy objects such as books or rocks, 2 marbles, clipboard, trundle wheel, horseshoe magnet, 2 bar magnets.

BACKGROUND INFORMATION

Chapter 1: Where are you?, pages 162-166

Location is the position of an object at a particular time. The location of an object is described in relation to a reference object. However, the reference objects must be familiar to people if they are to find the object's location.

The problem of locating one's position is more difficult when there are no landmarks. So on the oceans, for example, the compass and the positions of the sun and

the stars at various times are used to locate position.

Certain terms are especially helpful when providing people with reference objects. Qualitative terms, such as near, far, above, below, in front of and behind, or quantitative terms, such as 1 km from, blocks from, corner of, north, south, east and west, can be used.

Reference objects are used by people in many aspects of everyday living. For example, maps include reference objects that help people find their location; books have chapter and page numbers; cars have speedometers and gas gauges; and radios have dials to help people locate a specific frequency.

Chapter 2: Moving along, pages 167-173

An object is in motion when it changes position or location relative to a reference object. Motion may occur in one of three ways, in a straight line, in a curved line, or in a combination of straight and curved lines.

A person's observation of motion is always relative to the person's position. For example, if a person is standing watching a train going by, the people in the train are in motion. However, the people in the train would observe that they are stationary relative to each other, and that the person watching appears to be in motion in the opposite direction to the motion of the train. Or, consider two trains that are stopped side by side. When either train begins to move, the people in both trains would observe that the train in which they are seated appears to be in motion.

There must always be a force—a push or a pull—to cause an object to move, turn, and to stop moving. In other words, all stationary objects resist moving, and all moving objects resist stopping. This resistance is called inertia. The heavier the object, the greater the inertia that the object has. It is for this reason that the force needed to move a car or to stop a moving car, is greater than the force needed to move a bicycle or to stop a moving bicycle.

The chapter then considers the kinds of information that can be gleaned by the prints or tracks left by a moving object. For example, by observing the depth and length of stride of an animal track, it is possible to determine whether the animal was walking or running and the direction travelled. Also the speed at which a car was travelling at the time of an accident can be determined by measuring the skid marks made by the tires as the car was attempting to stop.

Chapter 3: What makes it move?, pages 174-181

Different kinds of forces can cause an object to move. These forces include wind, moving water, magnetism, gravity, muscles and machines. To move a stationary object, a force great enough to overcome three natural forces—gravity, inertia and friction—must be applied.

Gravity is the attraction between two objects. The greater the amount of mass (material) an object has, the more gravitational force that the object exerts. For example, the earth has a great deal of mass, and thus exerts a strong gravitational force on objects. The force needed to move an object must be greater than the force of gravity on the object.

Inertia is the tendency of all stationary objects to resist moving and all moving objects to resist stopping. The amount of force needed to overcome inertia depends upon the mass and the speed of the moving object. Inertia is one force that has to be overcome when catching a ball.

A third force that must be overcome in order to move a stationary object is friction. Friction can be decreased by lubrication and by smoothness. Although friction is generally a problem, it is also helpful. Without it, people would be unable to walk, hold a pencil, or do countless other everyday things.

TEACHING STRATEGIES

The purpose of the following activities and teaching strategies is to provide you, the teacher, with a wide variety of suggestions that can be used, together with the material presented in the textbook, to help guide your students in developing the processes and concepts of this unit.

Chapter 1: Where are you?, pages 162-166

- Pages 161-164 can be read and discussed.
- The following activity cards have been designed for specific purposes:
  "Locating Places, Activity Card 1"
  —using a reference object
  "Where Is ...?, Activity Card 2"
  —using specific phrases for a reference object
  "Which Way?, Activity Card 3"
  —giving precise directions within the school
  "Finding Out (page 165), Worksheet 1" is available.
- Mapping: Hallway walls—scale 2 cm = 1 m. Drawings could include bulletin boards, doorways, drinking fountains, display cases, etc.
  Classroom—scale 5 cm = 1 m
- Students could go on a walking field trip. Pictures could be taken of any signs in the community that give directions. (E.g. signs indicating streets, a hospital, schools, the police station, recreation centres, highways, nature trails, the next city or town, painted directional signs on road.) When a picture is taken a recorder should make note of (a) the sign and (b) its location using reference objects. Pictures and information can be mounted for display and discussed.
- The Shopping Centre Caper! A little planning + loads of enthusiasm = an unforgetable experience for everyone! This is a field trip to an average-sized shopping centre.
  (a) It is suggested that you contact the administrative office of the centre for an appointment to discuss your field trip. When you meet, it would

be helpful to:
- — discuss the purpose of the trip and the activities to be conducted
- — arrange a time and date for the trip
- — mention how the students will be supervised
- — obtain the names of stores and their contact person if students will be entering the stores
- — obtain permission to take pictures
- — obtain simple maps of the exterior of the mall and the floor plan of the interior of the mall. These will have to be prepared for students' use. You might wish to get brochures.

(b) It would be advisable to take as many parent helpers as you have groups.

(c) When students return from the field trip a number of activities can be done using the *data collected*:
- — questions could be made related to locating places in the mall
- — graphs can be made of:
  (1) number of cars, trucks, recreational vehicles
  (2) number of clothing stores
- — Finding the number of entrances, inside and outside seating areas and available facilities for handicapped persons.
- — Savings can be calculated on sale items.
- — "Architects" can calculate the perimeter of the mall using an adding machine or calculator.

(d) Activity cards 4-9 for the Shopping Centre Caper include—"Shopping Centre Architects", "Shopping Centre Planners", "Shopping Centre Sleuths", "Shopping Centre Bargain Hunters", "Shopping Centre Traffic Watch", "Shopping Centre People Watchers". "*A Second Look* (page 166), Worksheet 2" is available for review purposes.

Chapter 2: Moving along, pages 167-173

- — Pages 167-169 can be read and discussed.
- — Groups could be formed and given chart paper with the following headings:
  (a) Objects in the room that are in motion at sometime or another.
  (b) Things which move in a straight or curved line
  (c) Things that start something moving
  (d) Things that stop something moving
  (e) Things outdoors that move and the tracks they make.

  A 10 minute time limit should be sufficient for recording their findings under each heading.
- — The class can *brainstorm* situations when they have 'moved but not moved' (e.g. airplanes, skidoos, boating, elevators, walking sidewalks, ferris wheel, tobogganing).
- — Pages 170-171 can be read and discussed.
- — Have a yo-yo contest. Prizes could be offered for the longest time, the shortest time, the best try, and the trickiest stunt.
- — "What Stops It?, Activity Card 10" requires students to apply their knowledge to other situations.
- — Worksheet 3 for the "Finding Out" (page 171) is available.
- — Pages 172 and 173 can be read and discussed. "Snowy Evidence, Activity Card 11" gives students mapping experience in the use of the directional symbols, north, south, east and west. (Answers: (a) north (b) south (c) east (d) west (e) north)
- — Students would enjoy the game "Stop the Music". You can use a record or play the piano. Two spotters are chosen. The music starts and the children walk or skip through the room as long as the music is playing. When it stops, they must stop and hold their position. If someone loses his balance, that student is out also! The trick is to vary the length of time that the music is played (e.g. very long interval, very short, average, short, short). The last person to stay skipping is the leader for the next game.

  A greater challenge is to have the children stand still while the music is playing and walk during the silence. It is difficult but lots of fun!
- — Worksheet 4 for "A Second Look", (page 173) is available.

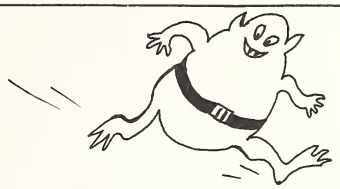
Chapter 3: What makes it move? pages 174-181

- — Pages 174-178 can be read and discussed.
- — The question could be posed: "Can you think of a person who has had experience in a 'no gravity' situation?" (astronauts)
- — Worksheet 5 for the "Finding Out" (page 177) is available.
- — Students could *research* the meaning of friction. See page 179 in the teacher's manual. Magazine pictures can be collected to show this concept. Each picture could be pasted to coloured cardboard or construction paper and numbered. A tape could be made for the listening centre to explain how friction works in each case.
- — Page 179 can be read. Articles in the picture could be available in the science centre for students to experience. Cards in the shape of a horseshoe magnet could have questions such as:
  - — Which objects were attracted to the magnet?
  - — Can the magnet pull more than one object at a time?
  - — Try some other objects. List them and say if they moved or not.
  - — Will two magnets stick together?
  - — If you lost your house key between two boards, how might you get it back?
  - — You spilled a box of pins on the floor. Can you think of a quick way to pick them up?
  - — Design a gadget using a magnet to keep paper clips tidy on your teacher's desk. Draw a picture of it.

— Page 180 can be read and discussed.
— Worksheets are available for the "Finding Out" (page 181) and "A Second Look", (page 181).

WORKERS WHO USE SCIENCE

The following persons could be invited to chat with the students: a police officer, an airline pilot, a captain of a ship, a member of a power squadron group or a member of the Canadian Coast Guard Service (Search and Rescue).
They might discuss:
— police — locating missing persons
— the use of the radar gun (perhaps one could be brought to show how it works)
— the way police dogs are trained to find people in hiding
— airline pilot — radio contact with airports
— their procedure for landing under poor weather conditions (e.g. fog, snow)
— ship's captain — experiences at sea
— how they plot a course
— power squadron member — the most common signs used in marine areas (e.g. channel markers)
— how they call the Coast Guard Service (Search and Rescue) if assistance is needed
— Canadian Coast Guard Service (Search and Rescue) — how they determine the location of a person in difficulty.



Locating Places

We can tell the location of a place or object by using a *reference object.* This helps a person to locate it quickly.
Suppose a person wants to know the location of a pencil sharpener. You might say: "The pencil sharpener is beside the door".
"Door" is the reference object.
A new student has come to your school. He would like to know the location of these places. Help him by giving him one reference object!

Pencil sharpener

Map

Waste paper basket

Library

Closest water fountain

Office

Grade 6 classroom

Nearest fire exit

Gym

Baseball field

Playground

Garbage can

Parking lot

Location, Motion, and Force, Activity Card 1

FINDING OUT (Page 165)

Why are these places important to you?

To which of these places do you walk?

To which do you ride a bike?

To which do you ride a car?

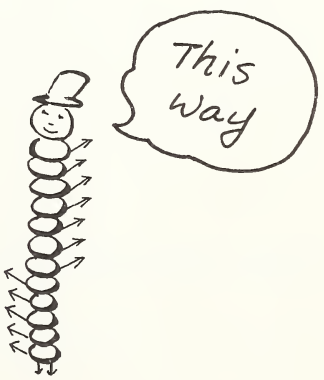
Location, Motion, and Force, Worksheet 1

We can find the location of a place or object by using these words and phrases:

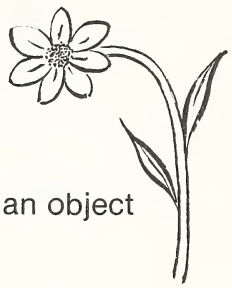
near	above	to the right of
beside	below	to the left of
between	behind	in front of

Look around your classroom.
Choose a person, place, or thing and give reference objects using these phrases:

1. The _____ is above the _____
2. The _____ are below the _____
3. The _____ is in front of the _____
4. The _____ is to the right of the _____
5. The _____ is behind the _____
6. The _____ are near the _____
7. _____ sits to the left of _____
8. _____ sits beside _____
9. The _____ is near the _____
10. The _____ is between the _____ and the _____.



Which way??



Sometimes it is important to know exactly how to locate an object or place. To do this we must give careful directions.

Suppose a new girl in your class asks you how to get to the library. You might say "Turn left, go the the end of the hall.
turn right and it is the second doorway."

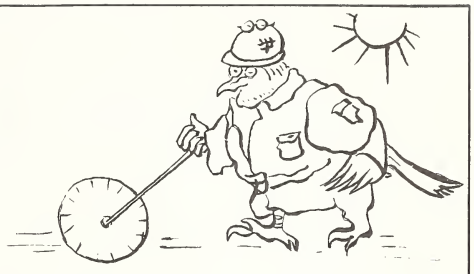
She will know exactly how to get there.

Here is your chance to give someone directions. A new girl in your classroom does not know your school very well. Write down exact directions on how to find ONE of these locations;

Gym	Baseball diamond
Library	Play area
Office	Gym equipment room
Kitchen	Custodian's room
Front door	Nearest fire extinguisher

Give your instructions to a friend. Let your friend read them and follow them. Did your friend reach the right place?
If so, you were VERY CAREFUL in giving directions!!

Shopping Centre Architects



You will need: Map or drawing of the outside of the mall
two pencils with erasers
a trundle wheel

Your task is to find the measurement of the outside of the mall. Each wall should be measured. Record each on your map or drawing. You can round off each length to the nearest metre.

When you have finished, WALK back to the meeting area, please.

When the class returns to the school you can use the calculator or the adding machine to find the total distance around the mall!

Location, Motion, and Force, Activity Card 4

Shopping Centre Planners

You will need: a drawing or map of the outside of the
two pencils with erasers
a clipboard

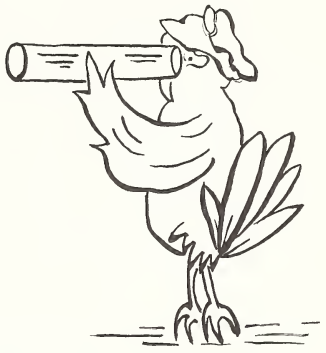
Your task is to show special areas *outside* the mall. Draw or print neatly the following on your map!

1. The entrances to the mall
2. Special parking areas for the handicapped
3. Seating areas
4. Phone booths
5. Mail boxes
6. Garbage cans
7. Sidewalks

When you have found all these features, WALK back to the meeting area, please.

Location, Motion, and Force, Activity Card 5

Shopping Centre Sleuths



You will need: map of mall
two pencils with erasers
clipboard

Hunt for the items listed below.
Mark their location on your map by using the letter (e.g. b).
Put a check mark ✓ beside each place or article that you have found.

a. An ad for soap
b. A bank
c. A set of washrooms
d. A ramp or railing for handicapped people
e. A seating area
f. A drinking fountain
g. A pay telephone
h. A store that sells magazines
i. A store that smells "delicious"
j. An ad about a community event

When you have found all these items, WALK back to the meeting area, please.

Location, Motion, and Force, Activity Card 6

A SECOND L  K (Page 166)

What is meant by your location?

When might you use reference objects?

What are some words that help tell about the location of something?

Location, Motion, and Force, Worksheet 2

Shopping Centre Bargain Hunters

You will need: a letter of introduction
2 pencils with erasers
a clipboard

Your task is to find 3 bargains in 3 different stores.
If you see a 'sale' sign—walk into the store.
Introduce yourselves—"Hello, my name is _____.
We are on a field trip today. This letter is for you from our teacher."
Ask "Do you mind if we write down 3 'sale' items—their regular price and the sale price?" Explain that you will learn to subtract using these prices.

Name of Store	Sale Item	Regular Price	Sale Price

Be sure to thank them when you leave.
WALK back to the meeting area, please.

Location, Motion, and Force, Activity Card 7

SHOPPING CENTRE TRAFFIC WATCH

You will need: two pencils with erasers
a clipboard
a watch

Your task is to watch for the kinds of vehicles coming into the centre at this entrance. If you see a tractor trailer come in, put a check mark ✓ under "transport trucks." Keep track of the traffic for ten minutes.

My location in this centre is the _____ Rd. / St. / Ave. entrance

What main roads or streets border the shopping centre? _____

_____

Would people from other towns visit this centre each week? _____

_____

Where do the transport trucks go when they come to the centre? _____

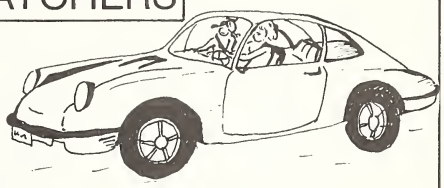
_____

Buses	Cars	Recreational Vehicles (vans, trailers, mobile homes)	Transport Trucks (very large trucks)

When you have finished, WALK back to the meeting area, please.

Location, Motion, and Force, Activity Card 8

SHOPPING CENTRE PEOPLE WATCHERS



You will need: 2 pencils with erasers
a watch
a clipboard

You should locate yourself near the entrance to the centre where cars enter. Find a safe place to stand (e.g. a sidewalk, a lawn.)
Your task is to keep score of the people who enter the shopping centre. 'People Watch' for ten minutes.

e.g. If a man drives in alone, put a check mark ✓ under column "Man Only"
If a man and 2 children drive in, put a check mark ✓ under "Man with Children"
If 2 adults drive in, put a check mark ✓ under "Adults Only"

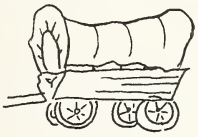
Man Only	Lady Only	Adults Only	Man with Children	Lady with Children
TOTALS				

Which group entered the centre the most?
When you are finished, WALK back to the meeting area, please.

Location, Motion, and Force, Activity Card 9

What STOPS it?

Location, Motion, and Force, Activity Card 10

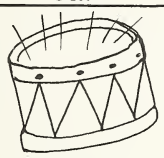


a wagon

a golf ball

a toy friction car

a boomerang



a drum

a softball

FINDING OUT (Page 171)

What started the yo-yo spinning?

What stopped it from spinning?

What did you have to do to keep the yo-yo moving up and down?

Location, Motion, and Force, Worksheet 3

A SECOND LOOK (Page 173)

What are two ways in which something may move?

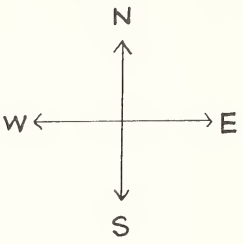
How can something be moving and not moving at the same time?

How might tracks be helpful to you?

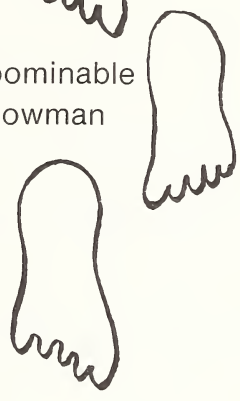
Location, Motion, and Force, Worksheet 4

Snowy Evidence

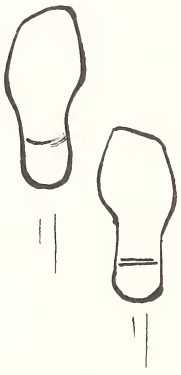
In which direction are they moving?

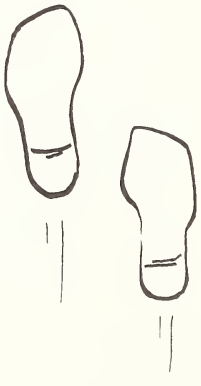


B. Abominable Snowman



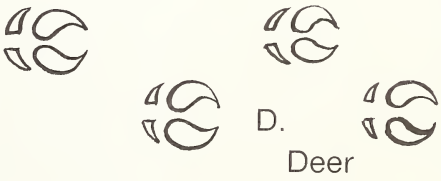
C. Mouse





E. Hunter

A. Fox



D. Deer

Location, Motion, and Force, Activity Card 11

FINDING OUT (Page 177)

How close were your guesses?

When might you need to know just how much something weighs?

Location, Motion, and Force, Worksheet 5

FINDING OUT (Page 181)

What force did you use to make the marble move?

Where did the force that moved the marble in the middle of the table come from?

Name some other times when a moving object will make something else move.

Location, Motion, and Force, Worksheet 6

A SECOND LOOK (Page 181)

What is a force?

Where does the force that helps you lift a book come from?

What is gravity, and what does it do?

Location, Motion, and Force, Worksheet 7

NOTES

NOTES

The Exploring Science Program